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Department of Physics

Govt. M.L.B. Girls P.G. Autonomous College, Bhopal (M.P.)

National Conference on

CONDENSED MATTER AND MATERIAL PHYSICS

(CMMP-2011) 13-14 October 2011

Sponsored by : University Grants Commission & Madhya Pradesh Council of Science & Technology, Bhopal

National Conference
on
Condensed Matter & Material Physics
CMMP – 2011

13th-14th October 2011

Souvenir & Proceedings

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Departement of Physics
Govt. M.L.B. Girls P.G. (Autonomous) College
Bhopal (M.P.)

Sponsored By

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Madhya Pradesh Council of Science and Technology

Ram Naresh Yadav

RAJ BHAVAN
BHOPAL—462 052

October 03, 2011

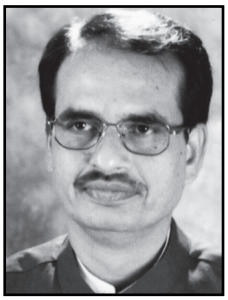
MESSAGE

I am very happy to know that the Department of Physics, Government Maharani Laxmibai Girls P.G. College, Bhopal is organizing a National Conference on Condensed Matter and MateriaI Physics (CMMP-2011) on October 13th and 14th 2011 and a souvenir is also being published on this occasion. It is also heartening to know that the conference will be attended by eminent scientists from all over the country.

I hope that the two day conference will focus on the recent development in the area of Condensed Matter and Material Physics. Science, particularly Physics plays a crucial role in the better advancement of society. I expect this conference to be a great platform for the exchange of scientific ideas and spreading of knowledge.

I extend my heartiest wishes to the organizers and warm welcome to all the delegates of the conference. I also extend my best wishes for the publication of the Souvenir.

Ram Naresh Yadav
(Ram Naresh Yadev)



शिवराज सिंह चौहान
मुख्यमंत्री

मध्यप्रदेश शासन
भोपाल - 462004

सं.क्र. 5740 / 03 अक्टूबर, 2011

संदेश

यह जानकर प्रसन्नता हुई कि शासकीय महारानी लक्ष्मीबाई कन्या स्नातकोत्तर स्वशासी महाविद्यालय, भोपाल के भौतिकशास्त्र विभाग द्वारा ''कंडेस्ड मैटर एवं मटेरियल फिजिक्स'' विषय पर एक राष्ट्रीय संगोष्ठी का आयोजन किया जा रहा है ।

भौतिक विज्ञान के क्षेत्र में भारत में अभूतपूर्व प्रगति हुई है । भारत में विज्ञान हमेशा से उन्नत अवस्था में रहा है । धातु विज्ञान से लेकर ज्योतिष विज्ञान, शल्य चिकित्सा में प्राचीन भारत ने जो मापदण्ड स्थापित किये थे वे अब भी प्रासंगिक हैं ।

विज्ञान, अध्यात्म और समाज कल्याण का आपसी तालमेल ही मजबूत समाज की नींव है ।

आशा है इस राष्ट्रीय संगोष्ठी से युवा प्रतिभाओं को मार्गदर्शन मिलेगा ।

संगोष्ठी की सफलता के लिए हार्दिक शुभकामनाओं सहित ।

(शिवराजसिंह चौहान)

लक्ष्मीकांत शर्मा
मंत्री
उच्च शिक्षा,तकनीकी शिक्षा एवं
कौशल विकास, संस्कृति, जनसम्पर्क,
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संदेश

यह जानकर प्रसन्नता हुई कि शासकीय महारानी लक्ष्मीबाई कन्या स्नातकोत्तर स्वशासी महाविद्यालय, भोपाल के भौतिकशास्त्र विभाग द्वारा Condensed Matter & Material Physics (CMMP-2011) पर एक राष्ट्रीय संगोष्ठी का आयोजन किया जा रहा है ।

मुझे विश्वास है कि राष्ट्रीय संगोष्ठी में श्रेष्ठ शोधपरक निबंध प्रस्तुत किये जायेंगे, साथ ही विद्वानों एवं विशेषज्ञों के मध्य सार्थक विचार विमर्श किया जावेगा । जिसका लाभ निश्चित रूप से शिक्षकों, शोधार्थियों एवं विद्यार्थियों को मिलेगा ।

राष्ट्रीय संगोष्ठी की सफलता एवं स्मारिका के प्रकाशन के लिए मेरी हार्दिक शुभकामनाएं ।

(लक्ष्मीकांत शर्मा)

Basant Pratap Singh
Principal Secretary

D.O. No. 225/pshe/2011

Ph.: (O) 0755- 2441056, 2674923 (Fax)

Govt. of Madhya Pradesh
Higher Education Department
Mantralaya, Bhopal - 462004

MESSAGE

I am very pleased to know that your College is organizing a National Conference on Condensed Matter and Materials Physics (CMMP-201 l) on l3th and l4th October, 2011.

The field of Condensed Matter and Materials Physics is an ever vibrant and exciting field and is capable of providing enough scientific and technological challenges to as many aspiring scientists. Be it revolutions in communication, computing, energy, chemical, transport or engineering industry, it has been possible only due to credible advances in materials technology and development of new class of materials. Materials development has always remained the backbone of human civilization and will remain the anchor point for all our future developments.

Research and Development (R&D) is a noble cause and intrinsically related to human prosperity. I am happy that the researchers of this soil are also contributing in this endeavour and providing an opportunity to the global researchers to interact with each other through the conference.

I wish the conference a great success.

(Basant Pratap Singh)

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OFFICE OF COMMISSIONER, HIGHER EDUCATION, MADHYA PRADESH
Satpura Bhawan, Bhopal—462 004

MESSAGE

I am pleased to learn that the department of Physics, Government Maharani Laxmi Bai Girls P.G. College, Bhopal is organizing a National Conference on Condensed Matter & Materials Physics (CMMP-2011) from l3 to 14 October 20l l. A souvenir is to be brought out to mark the occasion.

l hope, in this conference delegates from all parts of the country shall be participating and they would exchange their views and propose fruitful suggestions to activate their future programmes and formulate important guidelines.

l am confident that the souvenir will highlight the scientific and academic activities, including courses, research and development in the fields of Condensed Matter & Materials Physics and other relevant information for its wider circulations.

l wish the seminar a grand success and congratulate the participants for their endeavour.

(Dr.V.S.Niranjan)
Commissioner (HE)

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संदेश

प्रसन्नता का विषय है कि शासकीय महारानी लक्ष्मीबाई कन्या स्नातकोत्तर स्वशासी महाविद्यालय, भोपाल के भौतिक शास्त्र विभाग द्वारा राष्ट्रीय स्तर की संगोष्ठी Condensed Matter & Material Physics का आयोजन किया जा रहा है । इस सुअवसर पर राष्ट्रीय स्तर के विषय – विशेषज्ञ, विद्वान, शोधार्थी अपने – अपने अनुभवों एवं शोध पत्रों का वाचन करेंगे एवं संबंधित विषय पर अपने अनुभवों से अवगत करायेंगे । आशा करती हूँ कि प्रतिष्ठित एवं अनुभवी विषय – विशेषज्ञों, शिक्षकों, विद्वानों के विचारों से महाविद्यालय के सभी शिक्षकगण एवं विद्यार्थी लाभान्वित होंगे साथ ही विज्ञान के क्षेत्र में समाज को एक नई दिशा मिलेगी जिसका लाभ देश एवं प्रदेश को प्राप्त होगा ।

मैं, राष्ट्रीय संगोष्ठी के सफल आयोजन एवं इस अवसर पर प्रकाशित होने वाली स्मारिका के सफल प्रकाशन हेतु महाविद्यालय परिवार को बहुत – बहुत शुभकामनाऐं प्रेषित करती हूँ ।

(प्रोफैसर निशा दुबे)

राजीव गांधी प्रौद्योगिकी विश्वविद्यालय
(मध्यप्रदेश का तकनीकी विश्वविद्यालय)
Rajiv Gandhi Proudyogiki Vishwavidyalaya
(State Technological Un\versity of Madhya Pradesh)

DO Letter No. VC/PS/2011/175

दिनांक / Date : 07/10/2011

Prof. Piyush Trivedi
Vice–Chancellor

MESSAGE

I am happy to learn that the Department of Physics, Government Maharani Laxmi Bai girls P.G. College is organizing the National Conference on 'Condensed Matter and Materials Physics (CMMP-2011) on October, 13th and 14th, 2011.

I hope this National Conference will provide an excellent platform for young and talented scientists to present their research work and to interact with distinguished scientists of the country in different discipline of Condensed Matter and Material Physics.

I am sure that deliberations made by the scientists will be beneficial for advancement of science and technology.

It is a laudable effort of the organizers for choosing a very relevant and active field of research. Conducting the Conference as above, are vital part of quality improvement activities for all the stake holders viz a viz scientists, faculty, academecia and Students community.

I extend my warm greetings to the organizers and hope that the Conference will attain its desired goals.

7/10/11

(Prof. Piyush Trivedi)

PROF. BRIJ KISHORE KUTHIALA
Vice-Chancellor

MAKHANLAL CHATURVEDI NATIONAL
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Phone : Office (0755) 2551531, **Residence:** 6540523, **Fax:** 2553441
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MESSAGE

I am delighted to learn that the department of Physics, Government Maharani Laxmibai Girls P.G. College, Bhopal is organizing a National Conference on Condensed Matter and Materials Physics (CMMP-20l1) on October l3th & I4th 2011. The subject of the Conference is relevant to the current scientific & academic world.

Materials science is a multi disciplinary field which has ramifications in all the areas of technology, be it nuclear, space. medical, communication etc. lt is widely perceived that using the materials in the nano-crystalline forms would provide impetus to the development in many fields. The scientific deliberations during the conference will, I am sure, expose the young students to the latest developments in these ficlds.

My best wishes for the success of the conference.

(Prof. B.K. Kuthiala)

DEPARTMENT OF PHYSICS

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Professor & Head

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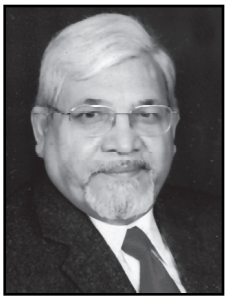

MESSAGE

It is a matter of great pleasure that the Department of Physics, Govt. Maharani Laxmi Bai Girls PG (Automous) College, Bhopal is going to organize two days National Seminar on Condensed Matter Physics (CMMP-2011) during 13 - 14 October, 2011. The organizer has considered various research areas in th above related subject and tried to strengthen the research objectives.

I extend my warm wishes to the Organizing Committee on this occasion and wish them all success in the conference.

(A.K. Gwal)

डॉ. जी. एस. चौहान
शिक्षा अधिकारी
Dr. G. S. Chauhan
Education Officer

ज्ञान विज्ञान विमुक्तये

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संदेश

यह अत्यंत हर्ष का विषय है कि मध्यप्रदेश, भोपाल में स्थित शासकीय महारानी कन्या स्नातकोत्तर स्वशासी महाविद्यालय में 14 एवं 15 अक्टूबर 2011 को भौतिकशास्त्र विभाग के द्वारा Condensed Matter & Material Physics (CMMP-2011) विषय पर दो दिवसीसय राष्ट्रीय शोध संगोष्ठी को आयोजन किया जा रहा है, और साथ ही इस पुनीत अवसर पर एक स्मारिका का भी प्रकाशन किया जा रहा है । इस तरह के आयोजनों से देश भौतिकी के विषय में उन्नति के पथ पर अग्रसर होता है । मेरी एवं विश्वविद्यालय अनुदान आयोग, केन्द्रीय क्षेत्रीय कार्यालय, भोपाल के समस्त परिवार की ओर से इस संगोष्ठी के समस्त कार्यकर्ताओं एवं सहभागियों को विशेषकर इस महाविद्यालय के प्राचार्य डॉ. (श्रीमती) मंजुला शर्मा को मैं हार्दिक शुभ कामनाये प्रेषित करता हूँ, जिन्होंने इतना अर्थपूर्ण विषय संगोष्ठी के लिए चुना । हम सभी शिक्षाविद् व आम नागरिक आशा करते हैं कि महाविद्यालय प्रतिदिन प्रगति के पथ पर अग्रसर होता रहे और मध्यप्रदेश में ही नहीं वरन् सम्पूर्ण राष्ट्र के शिक्षा जगत में अपना विशिष्ठ स्थान बनाये रखे ।

शुभकामनाओं सहित ।

05/10/11

(डॉ. जी. एम. चौहान)

Prof. Pramod K. Verma
प्रो. प्रमोद के. वर्मा
Director General
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Scientific advisor, Govt. of M. P.
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MESSAGE

It is indeed pleasure to know that your College is arranging National Seminar on **"Condensed Matter & Material Physics CMMP-2011."**

With limited resources and extraordinary scientific activities material science has become an important branch in Physics, Chemistry and Engineering. Whether it is material for space craft, for surgical kits, for transport material or for food container - everywhere new and smart materials are required . I am sure deliberations of this seminar will provide new and innovative material for the material scientists.

I wish the event every success.

Pramod K V

(Prof. Pramod K. Verma)

कार्यालय क्षेत्रीय अतिरिक्त संचालक उच्च शिक्षा भोपाल-नर्मदापुरम संभाग
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डॉ. यू.सी. जैन
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संदेश

यह जानकर प्रसन्नता हुई कि शासकीय महारानी लक्ष्मीबाई कन्या स्नातकोत्तर महाविद्यालय, भोपाल द्वारा भौतिकी पर राष्ट्रीय संगोष्ठी (सी.एम.एम.पी. 2011) का आयोजन किया जा रहा है ।

आधुनिक युग में प्रत्येक क्षेत्र में उत्कृष्टता तथा नई खोज के लिऐ अंतर्राष्ट्रीय स्तर पर प्रतिस्पर्धा चल रही है, हमारी युवा पीढ़ी इस दिशा में सक्रिय हो और देश को आगे बढ़ाने में योगदान दे ऐसी सभी की आशा है, राष्ट्रीय संगोष्ठी से प्रदेश की युवा पीढ़ी को मार्गदर्शन मिलेगा, ऐसा विश्वास है ।

राष्ट्रीय संगोष्ठी के आयोजकों तथा उसमें भाग लेने वाले प्रतिनिधियों को शुभकामनाएँ ।

4/10/11

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संदेश

यह अत्यंत हर्ष का विषय है कि महाविद्यालय के भौतिक शास्त्र विभाग के द्वारा राष्ट्रीय शोध संगोष्ठी Condensed Matter & Material Physics (CMMP-2011) का आयोजन किया जा रहा है । इस संगोष्ठी में भौतिकी की विभिन्न शाखाओं जैसे नैनो टेक्नोलॉजी, स्पेस भौतिकी, सुपरकण्डक्टीविटी, सेमीकन्डक्टर भौतिकी आदि पर राष्ट्रीय स्तर के वैज्ञानिक एवं शोधार्थी अपने शोध पत्र प्रस्तुत करेंगे । जिसमें सभी प्रतिभागी एवं महाविद्यालय के विद्यार्थी लाभान्वित होंगे ।

महाविद्यालय स्तर पर इस प्रकार की संगोष्ठी का आयोजन छात्राओं में शोध के प्रति रूचि जागृत करेगा ।

इस संगोष्ठी के सफलता के लिये हार्दिक शुभकामनाएँ ।

(डॉ. मंजुला शर्मा)

प्राचार्य

FOREWORD

The Department of Physics of Government Maharani Laxmi Bai Girls P. G. Autonomous College Bhopal is pleased to organize a "National Conference on Condensed Matter & Material Physics" on 13th & 14th of October 2011. We are very much honored by the overwhelming response from the senior scientists, academicians and research scholars of repute from all over India. The central theme of the conference is "Condensed Matter & Material Physics". The theme has strong links to many branches of Physics and Chemistry, for instance Condensed Matter Physics and Physical Chemistry, and has applications in many other fields such as High Energy Physics and Astrophysics. Internationally, the subject is perceived to be of great importance by all countries with scientific research programmes. The most challenging question pertaining to research field is the lack of stimulation and motivation. Much of the simulation for basic research comes from personal interactions and discussions amongst working scientists. The discoveries in Physics made during the first three or four decades of the last century demonstrated how important it is to encourage free discussions amongst peers. Homi Bhabha being a visionary saw the importance of periodic discussions among working scientists, while organizing basic research in India. He started off with an international conference in 1951, where some of the well known peers in Physics participated, on a subject such as fundamental particles. Over the many year symposiums, conferences, workshops have grow from very small beginnings to a very large activity with the feeling of pride and satisfaction.

During the conference, presentations and academic exchanges amongst the experts, professors, young researchers and students would be focused on the various fields of condensed matter physics like Phase Transition, Superconductivity, Nano Technology, Magnetic Properties, Spintronics etc. Extensive discussion will be during the technical sessions. The aim of this conference is not only academic interaction but also the cultural one with other fellow scientists working in different circumstances. This gives opportunity to the young scientists to present their work, making it clear that the methodology in science is mostly a logical intellectual activity. The conference enables the community of physicists to take stock of the cultural level, quality and size of the activity in the country and to examine critically the overall significance and impact of Indian effort in relation to the global progress in these fields and to discuss general directions in which future research should be undertaken.

The programme begins with a formal inauguration session followed by two days lectures ranging over all aspects of condensed matter physics. Apart from the formal question-and-answer sessions, there

was vigorous, continuous, scientific interaction among the participants. There were many invited talks, and several contributed through oral and poster presentations on a variety of topics.

The publication of abstract book would be particularly of value to funding agencies and research organizations to evaluate the programme. We believe that these volumes of the proceedings are of fertility and value for reference. It is our sincere hope that book reflects the general flavors of the deliberations and will help to judge whether the initial objectives of organizing the seminar have been fully met. We sincerely hope that the proceedings will become a much-used source of reference for researchers, students and professors in the field of condensed matter physics. We would like to thank the scholars and conference delegates for their active participation. We also would like to express our heartily gratitude to everyone who helped us to make the conference a success.

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Govt. Maharani Laxmibai Girls P.G. College in the City of Lakes

Bhopal, the city of glittering and shimmering lakes, is located in a particularly picturesque and fertile region of vindhya mountain range criss cross through lush forests. Bhopal's history is the unique story of succession of powerful women rulers (1744-1926) in the mail dominated world; a story woven into the rich tapestry of Indian history. The last ruler Begum Sultan Jahan, the great reformer and educationalist became an international figure as the first president of All India Conference on Education and first woman chancellor of the Muslim University Aligarh.

With the passage of time Bhopal grew up into a large sprawling city with an expanded industrial base.'The Bharat Heavy Electricals' was establish here in 1956, the first of its kind in Asia, barring Japan. Despite the greatest chemical tragedy of the gas leak disaster from the Union Carbide factory on 2nd December 1984, the city retains its beauty and peculiar features. its temperate climate, lakes, beautiful garden and mosque its tradition of communal harmony palaces, calligraphy, poetry and music grant it a distinctive image and make it a cultural capital.

Maharani Laxmi Bai Govt. Girls P.G. College, one of the oldest and most prestigious institutions was established in 1956. Though, established within the constrain of feudal and traditional society, it became a viable instrument for change and development of society. The institution, a synthesis of ancient wisdom and modern scientific temper; with four faculties (arts, commerce, science and home science) caters to the needs of approximately three thousand students. They are allowed to explore and evolve objectives. The environment, conducive to learning, is one which allows space to express opinion, setup and avail resources.

The college has successfully completed Fifteen years of autonomy and has justified its existence continually. The college seeks to revamp the education system at all levels. The syllabi, teaching and the examination system have been well planned and the schemes formulated to realize these objectives, are systematic, transparent, concrete and practical.

The principal of the college Dr. Manjula Sharma stresses that the purpose of education is to create skill, knowledge and awareness of our glorious heritage and the achievement of scientific outlook and commitment to the ideals of patriotism, democracy, secularism, socialism and peace.

Physics department is one of the most outstanding departments of the college. With Five faculty members, the department gives opportunity to the teachers and the students to make innovations, utilize their creative talents and improve standard. Research and project work is an integral of the curriculum.

With hardworking and dedicated faculty of the department, the department of Physics envisages achieving higher standard and having greater creativity and activity in future. The faculty members provide necessary guidance through discussion, conferences and participation in seminars. The department promotes that research and extenuation should be conducted in conformity with our national needs and priorities and ensures that our best talents make befitting contribution in international endeavor on societal needs.

Faculty of Physics Department

Dr. S. D. MISHRA

Dr. S.D.Mishra did his M.Sc (physics) from Bhopal University Bhopal in 1980 with gold medal. He was awarded Ph.D. degree in 1998 for his work on "Investigation of Ionosphere-Radio Beacon to Radar Observations ". He has published and Presented number of research papers in number of National and International Journals and Symposiums. He joined as assistant professor in 1980. He is a life member of PSSI. Presently He is working as professor and head of the department of Physics in Govt. M.L.B. Girls P.G College Bhopal. Presently he is controller exams in autonomous cell of the college.

Dr. SUDHIR JAIN

Dr Sudhir Jain did his M.Sc. Physics from Bhopal University, Bhopal in 1983. The same year he joined as a lecturer in Physics at Government P G College Bareli (Raisen) M.P. He has obtained M.Phil. degree from Barakatullah University, Bhopal in 1992. He awarded Ph.D. degree in 1995 from same university on the topic "Diagnostic studies of Ionosphere using satellite observations". He also had done PGDCA from Indira Gandhi National Open University, New Delhi in 2006. He has excellent academic carrier with several national scholarship/fellowships. He was organizing secretary of a national level seminar on Information Retrieval Techniques held in 1998. He also looked after Computer Science Department of the college. He became professor in 2006. Prof Jain's present focus of research endeavor includes study of Ionosphere with reference to Scintillation, Ionospheric Electron Content and Whistler studies. He has attended several National/International seminar/symposium. He has published at least 10 research papers in National & International Journals of repute and presented 42 research papers in conference/symposium. He has successfully guided several students for M.Sc. dissertation and presently guiding 3 teacher fellows for Doctoral degree.

Dr. GITANJALI PAGARE

Dr. Gitanjali Pagare did her M.Sc (Physics) in 1981from Govt. S.N.P.G. College Khandwa affiliated to Sir Hari singh Gaur University Sager. She has excellent academic career with national scholarship. She achieved Sir Chintaman Rao Memorial gold medal for getting first Position in her M.Sc degree. She obtained her M.Phil degree from Barkatullah University Bhopal in 1992. She has been awarded Ph.D. degree in 2006 from Barkatullah University Bhopal for her theoretical work on "Structural Phase Transition and Dynamical Properties of some rare earth compounds". She has published many research papers in the renowned international journals and presented papers in

many International / National conferences. In 2004 she had been invited from **University of California Berkley USA** to present her work on rare earth mono pnictides. She also presented her research papers in the international conferences **"ICMAT 2007" in Singapore** in July 2007 and in **"AIRAPT 2009" in Tokyo JAPAN**. Her latest fields of interest are computational condensed Matter Physics and electronic structure calculations. She guided many students of M.Phil., M.Sc dissertations and Ph.D. She successfully organized the national conference on **"Current Trends in Physics" in 2007** and **Workshop on Mathematika in 2009**. Recently she has been selected as a professor from MPPSC and secured **2nd** position in the merit.

Dr. ALPANA TIWARI

Dr. Alpana tiwari has obtained her M.Sc degree from Vikram University Ujjain in 1983. She did post graduate diploma in "**Space Sciences and Their Applications**" from Gujrat University, Ahmadabad in 1984. She joined as assistant professor at Govt. Arts and science college, Ratlam in1985. She received her M.Phil. degree from Barkatullah University Bhopal in 2005. She has been awarded Ph.D. degree from Barkatullah University Bhopal for her theoretical work on "Temperature Dependance of Phonon Properties of orientationally disordered matertials"in 2010. She has published several research papers in international/national Journals.She has presented paper paper on elastic properties of orientationally disordered matertials at international conference **AIRAPT-HPCJ in Tokyo, Japan in 2009.**

Mr. AMIT JAIN

Prof.Amit Jain did his M.Sc. (Physics) from Barkatullah University, Bhopal in 1990 with gold medal. He has done the PGDCA from the same university in 1992. He has started his carrier as Assistant Professor in 1993 after selection by PSC. His main area of interest is ionospheric research through GPS, specially the scintillation, ionospheric storms and modeling of total electron content. He has published 05 research papers in international journals and presented around 10 research papers in national and international conferences/symposium. He has also done the research in polar ionosphere at **arctic Indian station ("Himadri"), Ny-Ålesund, Svalbard, Norway, under "First Winter Phase Indian Arctic Expedition"** for one month in March 2008 using Global Positioning System (GPS). The work has been published in "Polar Science" Japan (2011). He completed his Ph.D. on "To Study the Climatology of Ionospheric Variability and Irregularities over Bhopal through GPS Observations" in 2010 under the supervision of Dr. Sudhir Jain and Dr. A.K. Gwal. Apart from his research interest, he has been working for the IT enabled education through video lectures and interactive learning course material design. He is the founder of the computer science department in this college. He has developed and maintaining the website of the college (www.mp.gov.in/ highereducation/mlbbpl).

Acknowledgement

Organizing a conference starting with the first announcement, receipt of papers, preparing the programme and bringing out the abstract book and souvenir is an arduous task, requiring lots of dedication, perseverance and tremendous efforts. A large number of persons contributed to all these activities and helped the organizing committee in various phases of the conference by taking part in the deliberations enthusiastically. It is my duty to record my gratitude to all of them. A special thank goes to Dr. Manjula Sharma, Principal Govt. M.L.B. Girls College for the encouragement and moral support.

The conference would not have been successful without the support of many individuals, groups and academic units. Prof. S. P. Sanyal Professor of Physics Barkatullah University Bhopal deserves a special mention for his generous help in organizing the conference and in the publication efforts. We owe our gratitude to Dr. Manju Tembhre, Principal Sant Hirdaram Girls College Bhopal for her constant support and guidance in the publication of abstract book. The Faculty members such as Dr. Shama Niyazi, Dr. Anita Shinde, Dr. Anita Puri Singh & Dr. Rameshwaram Tiwari deserve acknowledgment for the various roles they played during the conference. We are particularly grateful for the post graduate and research students who took leadership roles in the conference planning including Sunil Singh Chouhan, Ms. Sana Kausar, Tejas, Nishi Bairagi, Kinjal, Afreen, Neha, Shruti and Sonika Sharma for their 'yeomen' efforts before and during the conference. We were additionally lucky to have the involvement of undergraduate students. We must express our gratitude to all of them. In addition to the efforts of these listed individuals and groups, the success of the conference and the publication of the proceedings would not have been possible but for the Financial support given by the *University Grant Commission* and *M.P. Council of Science and Technology.* We must express our gratitude to them. We are also thankful to *State Bank of India,* shyamla hills branch & *Electronics & Electricals, Indore* for their Financial support.

Dr. Gitanjali Pagare
Organizing Secretary
"Condensed Matter & Material Physics"
CMMP-2011

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Invited Talk

Studies on some new Multifunctional Oxides and Devices

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ABSTRACT

Research in the field of oxide based multifunctional materials has attracted the attention of condensed mater physicists and materials scientists due to the interesting interrelated properties exhibited by them and possibilities of developing new SPINTRONICS based thin film devices for suitable applications. In this invited talk, I present our research results obtained on various functional oxides, namely, mixed valent manganites, diluted magnetic semiconductors (DMS) and multiferroics. Since, last decade, my research group at Rajkot, is actively engaged in research and development on variety of functional oxides in the form of polycrystalline bulk, nanostructures, thin films and devices to understand the basic mechanisms underlying them and explore their potential applications in SPINTRONICS devices.

Invited Talk

Di-Barium Nonatitanate Dielectric Ceramic Resonator for Mobile Communication Technology

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ABSTRACT

The commercial mobile communication has seen an exponential growth in recent years. This technological advancement owes to the availability of suitable electroceramics that function as the important circuit elements, like filters, oscillators with selectable frequencies, amplifiers and tuners. The term “Electroceramic” is used, in general, to describe ceramic materials that have been specially formulated to have desired electrical, magnetic or optical properties. Their characteristics can be easily tailored to meet specific requirements through exploiting the complex interplay between processing and chemistry, structure at many levels and device physics. A new group of electroceramic materials, called Dielectric Resonators (DR), could lead to reliable and clearer microwave communication signals used in mobile technology. DR's have completely replaced the bulky metallic cavities in most microwave applications for reasons of cost, dimension, mass, stability, efficiency, ruggedness and ease of use.
A DR is essentially an electronic component that exhibits resonance for a narrow range of frequencies, generally in the microwave band. The temperature coefficient of the resonant frequency can be engineered to have a desired value, to meet circuit designer's requirements. A good DR material must have low loss (i.e. large Q value), high temperature stability with a reasonably high relative permittivity and a very small change in resonant frequency as a

function of temperature. The complex titanates have not been given much importance in past though they have enormous research and application potential. The present work attempts to investigate these materials with special emphasis to Di-barium Nonatitanate ($Ba_2Ti_9O_{20}$) that has low loss; quality factor Q>10,000, temperature stable high relative permittivity (~39) and a very small change in resonant frequency as a function of temperature (~4 ppm/K). The fabrication of very dense bodies of $Ba_2Ti_9O_{20}$ ceramic with phase purity is of great practical importance. The realization of monophasic $Ba_2Ti_9O_{20}$ had, however, been a challenge. The synthesis of phase pure $(Ba_{1-x}Ca_x)_2Ti_9O_{20}$ materials with improved characteristics (i.e. narrow particle size distribution among the nano-crystallites, higher surface area and better sinterability) using Auto Ignition/ Internal combustion Method and its characterization have been reported in this paper.

Invited Talk

Nonlinear Optical Properties of II-IV and III-VI Semiconductor Nanostructures

P. K. Sen
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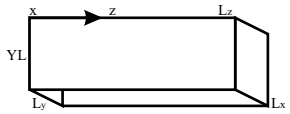
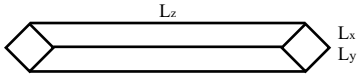
ABSTRACT

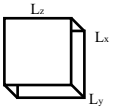
Since the advent of Lasers in 1960, a wide range of newer optical effects have been discovered. Among this class of processes, the nonlinear optical response of materials to highly intense coherent beam of radiation has been identified to be of paramount technological potentiality in high speed optical information processing including optical computing, optical information storage and communications. The area of nonlinear optics grew even faster since 1980_s with the development of nanomaterials with at least one of the dimensions below 100 nanometers. The lower dimensional semiconductor quantum structures with electronic confinements along different dimensions have made it possible to develop newer and newer optoelectronic devices. In the present talk, our emphasis will be on the nonlinear properties of dimensionally confined semiconductorquantum structures like quantum wells (QW_s), quantum wires (QWR_s) and quantum dots (QD_s).
The different configuration for QW_s, QWR_s and QD_s are as follows :



(a) Quantum well with Lx << Ly and Lz, Lz ≤ aex, aex being exciton Bohr radius and Lx, Ly, Lz are dimensions along x, y and z-axes, respectively.



(b) Quantum wire with Lx, Ly << Lz ; Lx and Ly ≤ aex.



(c) Quantum dot or quantum box with L_x, L_y and Lz ≤ a_{ex}.

It may be noted that the zero-dimensional QDs can have different kinds of shapes such as cubic, spherical, ellipsoidal, paraboloidal or pyramid-like. It is also important to note that the QD sizes are also not uniform and has a distribution pattern. Almost simultaneously, lasers have been fabricated vary successfully generating ultrahigh power pulses of time durations in the subpicosecond to femtosecond range, shorter than the dephasing times of the charge carriers. The possibility of not only optical computing but also of quantum computing is considered to be realities in tomorrow's information and communication technology. Today, laser-semiconductor interactions have gained significant importance in the light of the tremendous growth in the field of semiconductor nanotechnology with important electronic and optical properties being influenced by the reduction in dimensionality as well as shape and size distributions. The role of transient optical coherent effects for times shorter than the carrier relaxation timesin the semicondoctor nanostructures will also be discussed. We have made some detailed analytical study supported by numerical estimations of nonlinear effects in GaAs/AlGaAs quantum well waveguides. We propose to discuss the same in the talk.

Invited Talk

Spintronics and quantum Computing using Quantum dots

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ABSTRACT

The replacement of optical electronics with spin based electronics is the new vision for scientists and technologists as it can pave way for realization of atomic sized devices. The talk introduces frontline areas of technological importance which have their foundations in nanostructured materials. A brief introduction of quantum dots (QDs), specifically pure and magnetic impurity doped II-VI semiconductor QDs is given.

In the field of Spintronics, it is the spin of the charge that carries the information. In II-VI semiconductor QDs, the right and left circularly polarized photons are capable of exciting spin up/ spin down electrons in the excited state. This property can be utilized in generating spin polarized current which can have further implications in spintronic devices.

In magnetic impurity doped semiconductor QDs, the degeneracy of spin states is lifted and a differential phase shift occurs between the spin up and spin down state of electrons. The spin of a single electron can be used to encode binary logic bits 0 and 1. This aspect forms the basis of quantum computation. The two-level system can be used as a quantum bit and the interaction between the qbits can be used to implement quantum logic gates.

We have been working in the above areas and have briefly discussed the work carried out by us in the preparation and characterization of QDs, Exciton/Biexciton binding energies, role of shell thickness on them, spin splitting of states in QDs and formation of CNOT gate using QDs.

Invited Talk

Nanotechnology (a science of understanding the tiny!) the sky is the limit!!!

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JS College of Engineering, Hadapsar, Pune-28

ABSTRACT

The development of science & Technology is marching from macro to… micro to…nano; and it would probably be end of material device technology! In this presentation; we shall see the existence and importance of nano scale dimension, details of carbon nano tubes, fabrication methods & their applications in general with "Field Emission Application" in particular.

Electron sources are becoming increasingly important in vacuum tubes. Cold electron emitters using field emission show great potential which are known to be low-power, low-temperature, and high-current electron emitters. As field emitters do not require heating to generate electrons, they are more energy efficient. The cold nature of the emission prevents thermal drift of the cathode, allowing better and more stable electron focusing. Carbon nano-tubes have been shown to be extremely good field emitters and are among the most robust materials in terms of their mechanical, thermal and chemical properties (in non-oxidizing environments). Carbon nano-tubes can be used as electron sources in two different types of set-ups, namely single and multiple electron beam devices.

Field emission involves the extraction of electrons from a solid by tunneling through the surface potential barrier. It is a quantum effect. At a metal surface, electrons near the Fermi Level can overcome the energy barrier to escape to the vacuum level. The emitted current depends directly on the local electric field at the emitting surface E, and on its work function φ. The influence of the type, density and alignment of nano-tubes is being presented in the paper.

INRODUCTION

Electron sources are becoming increasingly important in vacuum tubes. Thermionic emitters are very inefficient because of the known reasons. A low-power, low-temperature, high-current electron emitter with Cold emission using field emission show great potential. As field emitters do not require heating to generate electrons, they are more energy efficient.

Carbon nanotubes have been shown to be extremely good field emitters and are among the most robust materials in terms of their mechanical, thermal and chemical properties (in non-oxidizing environments). Additionally, field emitters are less likely to produce out gassing that could potentially deteriorate the device and contaminate the system. Carbon nano tubes can be used as electron sources in two different types of set-ups, namely single and multiple electron beam devices.

FABRICATION

Arc discharge: The arc discharge is the oldest method for the production of both MWNTs and SWNTs. MWNTs can be produced in a carbon arc apparatus. An arc is struck between two graphite electrodes in a gas

atmosphere. MWNTs produced by arc discharge are long and straight tubes closed at both ends with graphitic walls running parallel to the tube axis.

Laser ablation: This method is investigated in 1996 to grow SWNTs. The synthesis can also be carried out in a horizontal flow tube under a flow of inert gas at controlled pressure. The flow tube is heated to ~1200°C by a tube furnace. Laser pulses enter the tube and strike a target consisting of a mixture of graphite and a metal catalyst such as Co or Ni. SWNTs condense from the laser vaporization plume and are deposited on a collector outside the furnace zone.

Catalytic growth: An alternative to the arc discharge and laser ablation methods is the catalytic growth of nanotubes. This method is based on the decomposition of a hydrocarbon gas over a transition metal to grow nanotubes in a chemical vapor deposition (CVD) reactor. For the production of MWNTs acetylene is usually used as source of carbon atoms at temperatures typically between 600 – 800°C. To grow SWNTs the temperature has to be significantly higher (900 – 1200°C) due to the fact that they have a higher energy of formation. In this case carbon monoxide or methane must be used because of their increased stability at higher temperatures as compared to acetylene.

FIELD EMISSION MECHANISM

Field emission is a quantum effect that involves the extraction of electrons from a solid by tunneling through the surface potential barrier. According to the Fowler-Nordheim model the dependence of the emitted current on the local electric field and the work function is exponential-like.

A striking aspect of nanotube field emission is the energy distribution of the emitted electrons. The FWHM (full width at half maximum) of the distribution is typically 0.45 eV for a metal while measurements on nanotubes suggest that the emission is more complicated than for a metallic emitter.

Nanotubes are thus ideally suited as field emitters, as their elongated shape ensures very high field amplification. Electron emission can be observed with about 100V already on a single nanotube! Otherwise also, CNTs have excellent materials properties like Large aspect ratio (>1000), Atomically Sharp tips (small radius of curvature at their tips); High temperature and chemical stability, High electrical and thermal conductivity, and high mechanical strength which make them have attractive field emission characteristics.

EMISSION CHARACTERISTICS

The emission characteristics of CNTs can be determined by measuring the current collected on a phosphor screen positioned several millimeters away from the CNTs. Carbon nanotubes can have diameters ranging from 1-100 nm and can have lengths of several microns. Although the emission of current through a nanotube is constrained because of its very small cross sectional area, the nanotubes can be arranged into an array allowing an unprecedented amount of current to pass through it. Carbon nanotube alignment is extremely important if high field emission currents are needed at low voltages. The nanotubes must be aligned in such a way that they are oriented perpendicular to the surface or substrate from which the voltage comes from. Since the geometry of carbon nanotubes can range greatly, the field emission characteristics can also have tremendous variation. The studies show that field emission is excellent for nearly all types of nanotubes. The threshold fields are as low as 1 V/μm and turn-on fields around 5 V/μm are typical. Also, nanotube films are capable of emitting current densities up to a few A/cm^2 at fields below 10 V/μm.

RESULT AND DISCUSSION

It observed that the catalytic tubes showed high emission voltages mainly because of their larger average

diameter. SWNT films show "only" comparable performances to closed MWNT films despite their smaller diameter. This may probably be from the preparation method since the SWNT tip density is far lower than the MWNT density. As for the huge difference between closed and open MWNTs, it is noted that even the best film emitter with opened tubes didn't even come close in performances to the worst emitter with closed tubes.

The analysis indicates that films of medium densities with nanotubes show emission at the lowest fields. **T**he density of the films, and hence the emitter geometry, plays an important role. The field amplification of an emitter, which determines the emitted current for a given applied field, is determined by the geometry only. The radius of curvature at the tip as well as the height of the tube over the substrate is also important. However, the distance between neighboring emitters has a decisive influence because of screening effects. There is actually an optimum distance between tubes for a maximal emitted current density, which corresponds to 1 – 2 times the tube height.

[The author conveys his thankfulness to Prof. T.J.Sawant, founder secretary, JSPM Group of Institutions, Pune, the Director, Dr.K.N.Barbole, Hadapsar campus, and the principal, Dr.M.G.Jadhav, JS College of Engineering, Hadapsar, Pune-28 for their kind attitude to-wards R&D activities.]

Invited Talk

Electronic depiction of magnetic origin in undoped and Fe doped TiO2-d epitaxial thin films

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ABSTRACT

We have investigated the electronic and magnetic properties of the pulsed laser deposited epitaxial thin films of Fe doped (4 at. %) and undoped anatase TiO2-d by photoemission, resistivity, magnetization measurements and ab-initio band structure calculations. Our study reveals the formation of local magnetic moment and finite density of states at the Fermi level indicating its metallic (degenerate semiconducting) behavior in both the films, leading to magnetic ordering at room temperature and a Kondo minimum in resistivity behavior. Present work suggests that there is a competition between magnetic ordering mechanism by JRKKY and moment screening mechanism by JKondo. In the light of this result the role of carrier density is also discussed in achieving the magnetic ordering in DMS materials either by defect engineering or by transition metal doping.

Invited Talk

Recent Advances In Organic Light- Emitting Diodes

B.P. Chandra

[1]*Department of Applied Physics, Ashoka Institute of Technology and Management,Torankatta,G.E.Road,Rajnandgaon,491441 (C.G.)*

ABSTRACT

Organic Light-Emitting Diodes (OLEDs) are currently under intense investigation for their applications in display technologies and solid state lighting devices. OLED displats are being used in cellphones, notebooks, digital video cameras, digital versatile disc (DVD) players, car stereos, alphanumeric displays, LCD backlight, and many other consumer tools that require colour displays. OLED-based TV screen more than 40-inch size has been produced by many electronic industries. OLEDs consisting of hole-and electron – transporting molecular materials or of spin – coated thin polymers films have been fabricated with active device thickness of less than hundred nanometer. For an applied voltage of about 3 to 5V, the OLEDs emit light brighter than conventional TV screen with much higher efficiencies, brilliant colours, large viewing angle, switching times fast enough for video real time image displays and lifetime well above 100,000 hours. Today, the displays based on OLEDs have become commercially available and certain small independent firms have been created especially to turn this innovative OLED technology into commercial reality. The present paper reports the construction and working of fluorescent and phosphorescent OLEDs. Furthermore, the quantum efficiency of OLEDs is discussed and it is shown that the quantum efficiency can be improved by fluorescent dopants and high efficiency phosphorescent OLEDs can be designed. Reduction in driving voltages by doped transport layers; transparent, stacked, and flexible OLEDs; passive and active OLED displays and applications of OLEDs are discussed. It is concluded that the field of OLEDs is wide open and looks very promising.

1. INTRODUCTION

Though electroluminescence (EL) in organic materials was observed long time ago, bright organic EL at low voltage was first announced by C.W. Tang and S.A. VanSlyke of Corporate Research Laboratories, Rochester, New York, USA in 1987 on 8-hydroxyquinoline aluminium (Alq_3) [1]. Another breakthrough in organic EL came in 1990 through the publication of J.H. Burroughes and his co-workers of Cavendish Laboratories. Cambridge, United Kingdom on light emitting diodes based on conjugated polymer poly(p-phenylene vinylene)(PPV) [2].The investigation of phosphorescent OLEDs by Baldo and his co-workers in 1998 has made a great attraction in the field of OLEDs [3]. Since these reports on low voltage bright organic EL, organic light emitting diodes (OLEDs) have attracted worldwide attention as a candidate for next generation of flat-panel displays. To date, various OLEDs have been demonstrated in order to obtain high brightness, long lifetime, white colour emission, multi-colour emission, and low operating voltage [4-7]. The new technology has large potential utilities as flat–panel displays, solid state lighting devices, etc., hence, almost all major commercial electronic and consumer industries as well as scientific institutions are actively engaged in doing commendable research work on it. The present paper reports the recent advances in fluorescent and phopsphprescent organic light emitting diodes.

2. CONSTRUCTION AND WORKING OF OLEDs

Organic light emitting diode is a device consisting of a single layer or double layer or multilayer of organic materials sandwiched between two electrodes at least one of which is transparent. Fig. 1(a) shows the schematic diagram of a single layer (SL) OLED. In this ease, homogeneous dense film of the appropriate material for emissive layer (EML) is coated on transparent conducting substrates (like Indian Tin Oxide) deposited onto glass by sputtering or electron beam evorporation technique. The film thickness usually lies in the range of less than 100nm. The second electrode is obtained by vacuum evaporation on this thin film. Generally, aluminum is used because of good stability but other materials like Mg-Ag Li-Al, etc. can also be used. For connections, external wires are attached to the electrodes by conducting carbon cement of silver paint. Several workers have fabricated ITO/PPV/Al devices where single layer of organic materials has been used. In order to assist carrier injection, many workers have used electron transporting layer (ETL) and/or hole transporting layer (HTL) in the OLEDs. Fig. 1(b) shows the configuration of double layer OLED and Fig.1(c) shows the configuration of double heterojunction (DH) multilayer OLEDs.

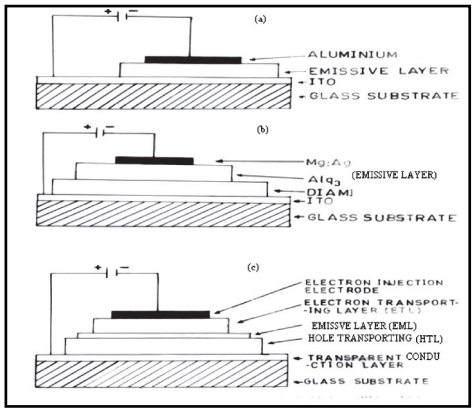

Fig.1. Configuration of (a) single layer(SL),
(b) double layer(DL), and (c) triple layers(TL) OLEDs.

The principle of organic light emitting diodes is quite different from that of inorganic light emitting diodes. In OLED, the light emission involves the following steps: (i) injection of charge carriers from electrodes, (ii) recombination of injected charge carriers, (iii) generation of singlet and triplet excitons, and (iv) radiative decay of singlet excitons. The injection of charge carriers from electrodes takes place by Richardson-Schottky thermionic emission model (at low voltage) or by Fowler-Nordheim tunneling model (at high voltage). Fig. 2 shows the energy level scheme for single layer and double heterostructure OLEDs.

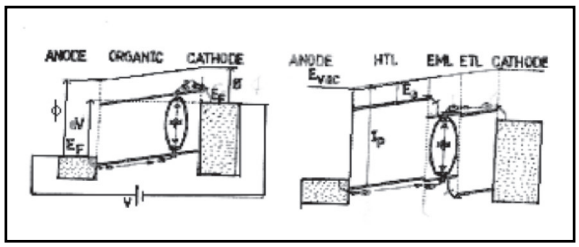

Fig. 2. Energy level scheme for single layer (left) and double heterojunction OLEDs (right) with an applied bias voltage V,illustrating the vacuum level E_{vac}, the Fermi level E_F and work function of the metallic contacts and hole and electron transport levels of the organic layers. The level offsets at the organic heterojunctions are determined by the different ionization energies I_s and electron affinities A_s of the adjacent layers.

In the single layer structure, a single component or multicomponent material is sandwiched between two metallic electrodes, which acts simultaneously as HTL, ETL and EML. In such layer, there is possibility that recombination may take place close to one of the electrodes, which may consequently decrease the EL efficiency of such structure because excited states are effectively quenched at the insulator/metal interface. However, the double layer structure composed of two different materials forming ETL and HTL allows recombination process to occur at the two insulators interface separated from the metallic contacts in which one of the materials serves as EML. Despite a considerable improvement in the EL efficiency of such double layer structure, the diffusion and quenching

of excitons at one of the electrodes, especially in thin film devices, still reduces the light output. The effect can be highly limited by forming a three layer structure (a double heterostructure). The EL efficiency of such a triple layer structure increases due to the confinement of both excitons and recombining charge carriers in a thin film EML placed between different HTL and ETL materials, whereby the confinement of excitons, eliminates their quenching at the electrodes.

To date, the temporal, time–delay, current–voltage,brightness-current, brightness-voltage, efficiency, thermal, spectral, electrode, materials, dopant, thickness, stability, and preparation characteristics of OLEDs have been studied in detail.

3. QUANTUM EFFICIENCY OF OLEDS

Chandra and Chandra [8] have derived the expression for internal quantum efficiency η_{EL} of OLEDs, which is as given below:

$$\eta_{EL} = \frac{\gamma_1}{(\gamma_1+\gamma_2)} \cdot \frac{\delta_1}{(\delta_1+\delta_2)} \cdot \frac{\delta_1}{\delta_2} = P_{ex}\eta_r \qquad (1)$$

where γ_1 and γ_2 are the recombination coefficients for bimolecular recombination producing exciton and no exciton, respectively and $\gamma = (\gamma_1+\gamma_2)\delta_1$ and δ_2 are the rate contants for the radiactive and non-radiative decay of excitons, respectively , and $\delta = (\delta_1+\delta_2)$ δ.$P_{ex} = \gamma_1/\gamma$, is the probability for the formation of excitons during the bimolecular recombinations, and $\eta_r = \delta_1/\delta_2$, is the efficiency for the radiative decay of excitons .

If P_s is the free –charge –carrier spin statistics, and η_{PL} is the photoluminescence quantum yield, then $\eta_r = P_s\eta_{PL}$. Thus, Eq. (1) can be written by as

$$\eta_{EL} = P_{ex}P_s\eta_{PL} \qquad (2)$$

Because of the spin –statistics three times more triplet than singlet excited sates are created in electron – hole recombination process characterized by second – order rate constants. Therefore, the probability, P_s, that a singlet excited state will be created in recombination events , is 1/4,that is, P_s = 1/4. For P_{ex} = 1 and P_s = 1/4, the upper limit of η_{EL} is 0.25 of the PL quantum yield. This limit can be increased up to 0.35 η_{PL}, if triplet exciton annihilate to create emitting singlets.

It is evident from E_q. (2) that η_{EL} can be increased by increasing P_{ex} ,P_s and η_{PL} . It has been shown that P_{ex} depends on the charge imbalance, temperature, and strength of the electric field [8].The increase in quantum efficiency η_{EL} of OLEDS by increasing η_{PL} , can be achieved by dopings limited amounts of fluorescent materials in the EML of florescent OLEDs. It has been shown previously that the quantum effiency of OLEDs cannot exceed 25%of the PL quantum yield because only 25% singlet excitons participate in radiactive process and 75% triplets excitons decay non-radiatively. This intrinsic limitation can be increased by incorporating phosphorecent molecules into a host matrix materials, where light is generated from both the singlet and triplet excitons and the internal EL quantum efficiency of OLEDs approaches close the unity [9,10]. In this case, the quantum mechanical selection rule is broken by spin- orbit couplings caused by incorporating heavy metal into the emissive layer and thus triplet excitons also participate in the radiative process and consequently η_{EL} increases.

4. RECENT ADVANCES IN OLEDS

4.1 Improving Quantum Efficiency of OLEDs Using Fluorescent Dopants

In general, the quantum yield of organic materials is considerably lower in solids state . It can be increased by doping a small amount (~1 mol%)of a fluorescent dye into the conductive host materials forming EML of OLED

[11].Subsequently, the increased PL yield gives rise to higher quantum efficiency of OLED.The application of electric field causes charge carrier injection and the subsequent electron- hole recombination gives rise to exciton formation in the conductive host molecules [12] , whereby, the excited host molecules can transfer its exciton to the doped fluorescent molecule by a Forster mechanism[13].The Forster transfer is non–radiactive process and it involves the excitation of the dipole-transition of the dopant molecule by the simultaneous de-exctation of the host molecule. It requires that the excited state energy of host be equal to (i.e. resonant with) the unexcited HOMO-LUMO gap of guest molecule. For this to occur, the host fluorescence spectrum should overlap the absorption spectrum of the dopant.

There is an alternative mechanism of exciton formation on the guest molecules which requires the trappings of hole on the dopant prior to its recombination with an electron on the host (or vice versa), thereby, forming the rediative exciton. If the concentration of freely moving excitons is high in a single components materials , the collision of two excitons leads to exciton – exciton annihilation [14]. However, if the excitons are rapidly trapped in the dopants , then the concentration of freely moving excitons and thus their annihilation probability is considerably reduced and quantum efficiency of OLED increases . Furthermore, an additional advantage of doping a host with fluorescent molecules is that it provides an effective means to tune the emission colour of OLED. For example, using of blue fluorescents host, the entire visible spectrum is accessible simply by using an admixture of different guests into the emissive layer of OLED [15].

4.2 High Efficiency Phosphorescent OLEDs

Due to the necessity of spin conservation, the radiative transitions of triplet excitons are quantum mechanically forbidden. The quantum mechanical selection rule can be broken by spin-orbit coupling caused by incorporating a heavy metal in to the emitting organic molecule.

When the coupling of the exciton spin with the orbital angular momentum of the metal electron takes place, the exciton spin is no longer a good quantum number. In this case, therefore, the selection rule of spin conservation is weakened and intersystem crossing from a singlet into a triplet state becomes possible. It is to be noted that spin-orbit coupling is especially strong when the lowest singlet state is a metal-to-ligand charge transfer (MLCT) state. This is the case, for example, for fac-tris (2-phenylpyridine) iridium (III) $(I_r ppy)_3$, a material which is used as a high efficiency phosphorescent emitter in green OLED [16,17].

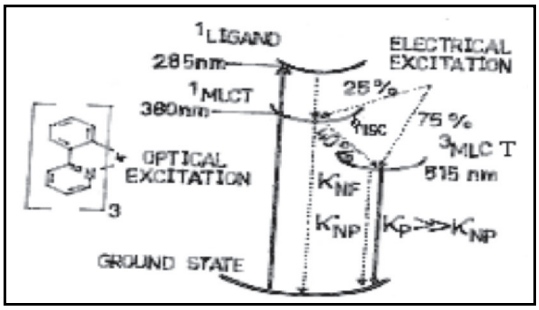

Fig3 Chemical structure and energy level scheme for the metal organic phosphor I_r $(ppy)_3$(after ref. [17]). In this case, the ligand singlet state and metal –to-ligand charge – transfer singlet state were determined by the absorption peaks in toluene-solution (10^{-5} M) and the triplet MLCT, state (^{3} MLCT, i.e. T_1) was estimated from the phosphorescence peak. Here, $K_{NF,}$ K_P and K_{NP} represent quantum yields for non-emissive transitions from MLCT intrinsic phosphorescent transitions, and nonemissive transitions from ^{3} MLCT , respectively and P_{isc} is the yield from intersystem crossing from ^{1}MLCT to ^{3}MLCT.

In the PL process of phosphorescent molecules, an electron is excited from S_0 to S_1 or any other singlet state from where it rapidly thermalizes into S_1 (Fig. 3). Then from S_1 it undergoes intersystem crossing (ISC) to the triplet state T_1 with a probability P_{isc} . Finally, it can decay form T_1 to S_0 radiatively or non-radiatively with a rate constant $_1$ and $_2$ respectively. Thus, the efficiency for phosphorescent PL can be expressed as

$$\eta_p = P_{isc} \frac{\delta_1}{(\delta_1 + \delta_2)} \quad \text{..... (3)}$$

In the case of EL, the situation is different. Due to the electrical excitation, both singlet and triplet excitons are directly created on either the guest or host molecules with a statistical splitting of $_{st}$ = 25% singlets and $(1-\gamma_{st})$ 75% triplets. If the concentration of guest molecules in a host molecular matrix is sufficiently high and a suitable matching of the energy levels to enable energy transfer, is available, it can be assumed that all excitons generated on matrix molecules will completely transfer their energy to the guest within their lifetime. Accordingly, the internal quantum efficiency of EL is given by

$$\eta_{EL} = [(1-\gamma_{st}) + \gamma_{st} P_{isc}] \frac{\delta_1}{(\delta_1 + \delta_2)} \quad \text{..... (4)}$$

Thus, it is evident that $_{EL}$ will be at least 75%, if $\frac{\delta_1}{(\delta_1+\delta_2)}$, is close to unity.

In recent years, phosphorescent OLEDs with internal quantum yields of nearly 90% have been demonstrated using $I_r(ppy)_3$ [9] or $(ppy)_2Ir(acac)$ [10]. A general problem involved in phosphorescent OLEDs is that its efficiency decreases more severely at higher brightness level as compared to that of a fluorescent OLED (Fig. 4). This is caused as a result of the longer lifetime of triplet excitons (typically 500 ns [17] to 100 s [18]) in phosphorescent materials as compared with that of singlet excitons (10ns), which leads to triplet annihilation or quenching of triplet excitons by charge carriers at high brightness [19]. The effect of annihilation can be reduced by designing phosphorescent molecules with short lifetime, i.e., with a large spin-orbit coupling. An alternative approach is to co-dope the host with a phosphorescent sensitizer and fluorescent emitter [20]. In this case, long-lived triplet states are avoided by fast and efficient resonant Förster transfer from the triplet state of the sensitizer to the singlet state of the emitter. In fact, the long lifetime and accordingly long diffusion length require device architectures consisting of exciton blocking layers, which eliminate the quenching at contact or at interface [10, 16].

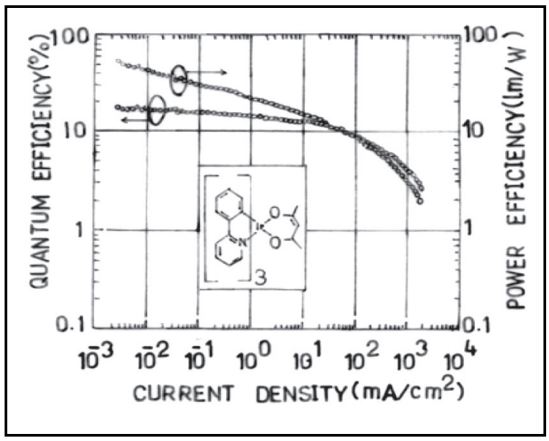

Fig4 Dependence of external quantum and power efficiency on current density of an ITO/HMTPD (60 nm) 12% - $(ppy)_3$ $I_r(acac)$: TAZ (25 nm) / Alq_3 (50 nm)/Mg : Ag OLED. Inset: The chemical structure of $(ppy)_3$ $I_r(acac)$. Maximum external quantum efficiency of 19% and power efficiency of 60 lm/W were obtained (after ref. [19]).

It is to be noted that the price one has to pay for the increased efficiency in phosphorescent OLEDs, is the energy loss in the transition from singlet to triplet state. In fact, for a given emission wavelength this requires host materials having wider band gap.

In the case of the emission at longer wavelengths, for example, in the case of green phosphorescence emission, resonant exothermic energy transfer takes place from both the host singlet and triplet states to the phosphor. However, when triplet energy of the phosphor increases, it becomes difficult to find a suitable host with an

appropriate high energy triplet state. In this connection, one route to efficient blue electrophosphorescence involves the endothermic energy transfer from a near-resonant excited state of the host to the higher triplet energy of the phosphor [21]. This process can be very efficient if the energy required in the transfer is not significantly greater than the thermal energy [7]. The occurrence of recombination predominantly from a high energy phosphor state in quasi-equlibrium with a low energy host singlet state, appears surprising. This becomes possible because the triplet lifetime of the phosphor dopant is significantly less as compared to the forbidden triplet transition of the fluorescent conductive host. For example, with 4, 4`-N,N` dicarbozole biphenyl (CBP) as a host (triplet energy 2.56eV) and Flrpic as guest (triplet energy 2.62 eV), a maximum internal electroluminescence quantum efficiency of ~5.7% and a luminous power efficiency of 6.3 lm/W have been achieved [22]. This fact clearly demonstrates significant improvement over efficiencies of blue fluorescent emitters reported till now.

4.3 Reduction in Driving Voltages by Doped Charge Transparent Layers

For obtaining a high power efficiency and low driving voltage, efficient charge injection at interfaces and low ohmic losses in the transport layers are required. The doping of HTL and ETL enhancers the density of charge carriers. Another advantage of doped transport layer is that they can enable efficient charge injection from contacts even over a high energy barrier. For very high doping levels, depletion region at the interface becomes sufficiently thin, and therefore, charge carriers can tunnel through the barrier.

An OLED can benefit from a p-i-n structure. The emission region is undoped (intrinsic) as dopants tend to provide nonradiative exciton recombination centres. Thin undoped exciton blocking layers are inserted between the emission layer and doped charge transport layer to keep the efficiency high. Recently, the approaches of using phosphorescent emitters combined with the doping of the charge transport layers have resulted in low voltage, high efficiency p-i-n OLEDs.

4.4 Transparent, Stacked and Flexible OLEDs

OLEDs offer new possibilities not accessible by other exhisting display technologies such as liquid crystal or plasma displays.

Transparent OLEDs

Transparent OLED (TOLED) uses transparent cathode, e.g. ITO sputtered on top of the active organic layers, to create displays that can be made both top and bottom emitting on an ITO coated substrate.

Stacked OLED Display

Transparent OLEDs are the basic buildings block for a novel pixel architecture. This is based on stacking the red, green and blue subpixel on top of one another instead of side by side positioning used in conventional full colour display. Such architecture improves display resolution up to three-fold as individual stacked pixel can provide full colour. In stacked OEDs, each pixel emits the desired colour, and therefore, it is perceived correctly from any viewing distance.

Flexible OLED Displays

Organic layers can easily be deposited onto a wide variety of substrates that range from optically clear plastic films to reflective metal foils. These materials provide the ability to conform, bend or roll a display into any shape.

4.5 Passive and Active Matrix OLED Displays

In a passive matrix (PM) OLED display, on the surface of a transparent substrates, such as glass or plastics,

columns of transparent conducting anode contacts are patterned. Onto their surface the full organic light emitting structure is deposited with the hole transporting layer in contact with anode. Then the display is completed by depositing rows of metal cathode contact. For addressing a particular OLED picture element or pixel, a potential is applied across the appropriate row and column contacts, and current flowing across the organic layers at the intersection of those contacts, causes lighting up the device. A full image is produced by rapidly scanning through the row lines while individually energizing the appropriate columns line using line driver electronics connected to the row and columns at the edge of the PM display. Typical handheld video image display pixel must be less than 250 μm across and must be spaced by less than 50μm.Passive matrix displays are limited in size with practical dimensions not exceeding 5cm×5cm.PMOLED is ideal for small cheap displays such as smart-cards and watches.

The fabrication complexity can be reduced and display performance can be increased by using a transistor switch at each intersection. The switches are set by the line driver electronics once per each display frame, resulting in an active matrix (AM) OLED display. In this case pixels emit simultaneously and continuously during each display frame, so that the maximum brightness of a particular pixel does not have to be multiplied by the number of display rows to achieve its desired viewing brightness, as in the case of PMOLED displays. In AMOLED display, polysiticon thin film transistor technology is used. Using this approach very attractive active matrix full colour OLED displays (13 inch and 17 inch diagonal) have been demonstrated. The power consumption of such displays is a factor of 2-3 times lower than that for comparable liquid crystal displays.

5. APPLICATIONS OF OLEDs

The important applications of OLEDs are as given below:

(i) OLED technology is being used in commercial applications such as small screens for mobile phones and portable digital music player (mp3 player), car radios and digital cameras and also in high resolution micro-displays for head-mounted displays.

(ii) Prototype displays have also been made flexible and rollable which take advantage of OLED unique characteristics.

(iii) OLED are being used in electronic paper.

(iv) OLEDs can be used where LCDS are used.

(v) In 2004, Samsung has announced the first 40 –inch OLED TV based on this technology. In January 2008, Samsung showcased the world's largest and thinnest OLED TV at the time, whose size was 31-inch and thickness was 4.3 mm. In October 2008, Samsung showcased the world's thinnest OLED display, also the first to be flappable and bendable. It measures just 0.05 mm (thinner than paper), yet a Samsung staff member said that it is "technically possible to make the panel thinner". In May 2008, Samsung unveiled an ultra-thin 12.1 inch laptop OLED display concept, with a 1,280×768 resolution with infinite contrast ratio. LG plans a 55 inch prototype TV for 2012.

(vi) OLED can also be used as solid state lighting source. As by now the OLED efficacies and lifetime already go beyond those of tungsten bulbs, white light OLEDs are under worldwide investigation as source for general illumination (e.g. the EU OLLA project).

6. CONCLUSION

Organic light emitting diodes are very promising, and therefore, presently they are attracting the attention of a very large number of researchers all over the world. Further investigations in material synthesis and device fabrication are needed. Furthermore, it is very much necessary to have a basic understanding of the properties of materials used in this technology. More inputs are required in this important field for commercialization of the

technology. Conclusively, it can be said that the field of OLEDs is wide open and looks very promising.

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Invited Talk

Enhanced Photovoltaic Effect In Multi-layered Solar Cells

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ABSTRACT

Soaring petroleum price and global warming have fueled the intensive research for alternative energy sources and technologies. Photovoltaic provide clean energy that can reduce world's dependency on petroleum. Silicon based solar cells have achieved power conversion efficiency of around 24%; however the high efficiency is offset by high cost. Much effort has recently been directed towards developing new and better solar energy conversion devices. Use of multiple band gap devices can lead to more efficient matching and utilization of solar energy. The energy conversion efficiency can also be increased by using multilayered semiconductor photoelectrode.

Two different approaches have been used to prepare multiple band gap solar cells. One is use of layers of semiconductors of different band gaps. The multi layered photo-electrode with lattice matched semiconductors utilizes larger potion of solar radiations. It was observed that the performance and efficiency are very much improved for double or multiple layered tandem solar cells.

The second approach is use of layers of various nanostructures of same material having different band gaps. The effective band gap of a material can be varied by changing the size and/or structure in case of nanostructured materials. Multi-layered photo-electrode can be prepared by depositing various sized nanosctrutured layers of same material. Enhanced photovoltaic effect is observed in photoelectrochemical solar cells using the multi-layered photoelectrode. The multi-layered tandem arrangement ensures much better match to solar spectrum and provides direct conduction path for charge carriers.

INTRODUCTION

Soaring petroleum price and global warming have fueled the intensive research for alternative energy sources and technologies. In the last decades solar cells converting sunlight into electricity have attracted much attention as a proper candidate for main energy source in future. Photovoltaic provide clean energy that can reduce world's dependency on petroleum. Silicon and gallium arsenide based solar cells have achieved power conversion efficiency of around 24%; however the high efficiency is offset by high cost [1]. Much effort has recently been directed towards developing new and better solar energy conversion devices. A high degree of sophistication has already been achieved in the fabrication of p-n junction solar cells. To produce low-cost and large area solar cells, many new device structures and materials are being developed.

In order to improve the absorption of solar radiation, materials with broad absorption band have to be designed and produced, or different narrow-band absorbers have to be stacked or mixed in multiple junction. When two or more materials with non-overlapping absorption spectra are used in tandem or multi-junction solar cell, broader range of solar spectrum can be covered. In multi-junction configuration transmission and thermalization losses are also reduced [2]. Use of multi-band gap device can lead to more efficient matching and utilization of

solar energy. Recently several design schemes have been proposed to increase the power conversion efficiency of photovoltaic devices. By using two or more p-n solar cell junctions, tandem cells made of different semiconductors, a multi-hetero-junction design yields a better match to the solar spectrum than a single junction cell and may provide the efficiency of conversion greater than 50%.

In multi-junction cells, materials of different energy band gap are stacked over one another in such a way that light first falls on the material having largest band gap (Fig.1). High energy photons are absorbed there and lower energy photons are transmitted to second layer. It also absorbs higher energy photons of the remaining radiations and transmits lower energy photons to next layer, which may be absorbed there. Thus a larger portion of solar radiations is utilized for obtaining electrical energy. The energy conversion efficiency can also be increased by using multilayered semiconductor photo-electrode. High efficiency can be achieved in structure with optimized band gaps and with good current and lattice matching.

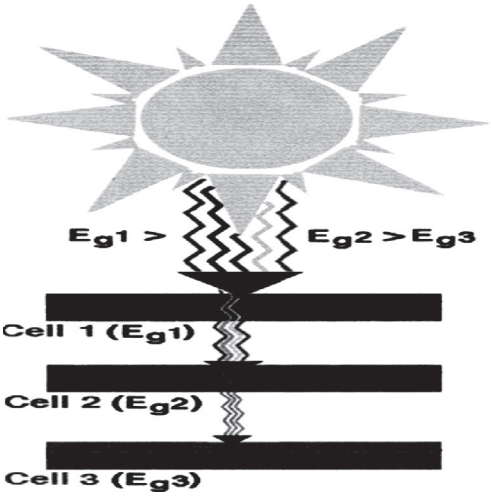

Fig.1 Multi Layered Solar Cell (from internet Dt.10-9-11)

Two different approaches have been used to for multiple band gap solar cells: 1) use of layers of materials with different band gaps, i.e. heterojunction solar cells and 2) use of different nanostructures of same material i.e. nanostructured solar cells. An overview of tandem or multi-junction solar cells is presented here.

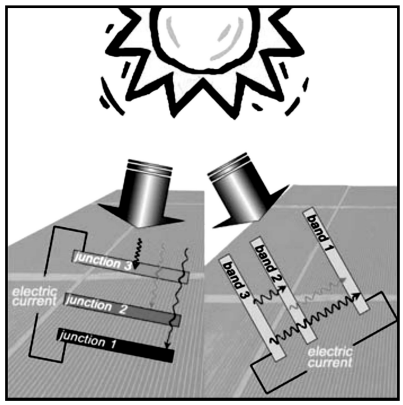

Fig.2 Multi-layered and Multi-gap Solar Cells (from internet Dt.10-9-11)

In a multilayer solar cell (Fig.2 left), each layer is a different alloy with a different band gap, which responds to a different frequency of sunlight. A multigap solar cell (Fig2 right) has only a single layer of material, but multiple band gaps allow it to respond to a range of different frequencies.

1) HETERO-JUNCTION CELLS

Three different types of materials are generally used for hetero-junction stacked solar cells: inorganic semiconductor layers in solid state cells; inorganic semiconducting material tandem layers as photo-electrodes in photo-electro-chemical cells and organic tandem layered cells.

A) Inorganic tandem cells

A number of researchers have reported multi-junction solar cells using III-V or II-VI semiconductors having potential for achieving high conversion efficiency of over 50% and are promising for space and terrestrial applications.

Yamaguchi [3] have reported mechanically stacked 3-junction cells with quite high efficiency. As a result of InGaP top cell material quality improvement, development of optically and electrically low-loss double heterostructure InGaP tuned junction, photon and carrier confinement, and lattice matching between active cell layers and substrate, InGaP/InGaAs/Ge monolithic cascade 3-junction cells with an efficiency of 31% at 1-sun AM1.5 and InGaP/GaAs/InGaAs mechanically stacked 3-junction cells with a highest efficiency of 33.3% at 1-sun AM1.5 have been realized. They have also demonstrated low cost, high efficiency, better radiation resistance of GaAs thin film solar cells with novel structure fabricated on silicon substrates.

Yamaguchi [4] proposed AlInP-InGaP double hetero (DH) structure top cell, wide band gap InGaP DH structure tunnel junction for sub cell interconnection, and lattice matched InGaAs middle cell in 2004. They have successfully fabricate world-record efficiency concentrator InGaP/InGaAs/Ge 3-junction solar cells (Fig.3) with an efficiency of 37.4% at 200-sun AM1.5 as a result of widening top cell band gap, current matching of sub-cells and precise lattice matching of sub-cell materials,. In addition they have realized high efficiency concentrator InGaP/InGaAs/Ge 3-junction solar cell modules (with area 7000cm^2) with an out door efficiency of 27%.

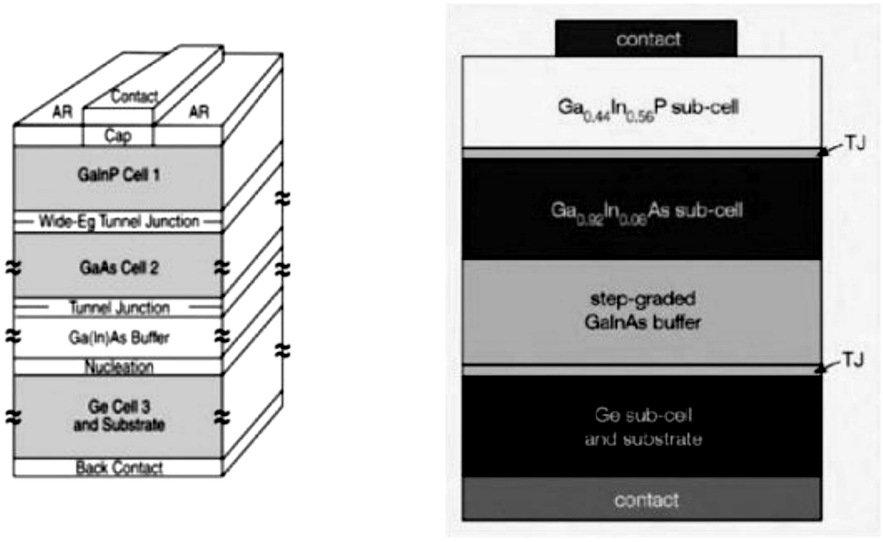

Fig.3 Structure of Multi-junction Solar Cell (from Ref.4)

Dharmadasa et al.[5] have reported $CuInSe_2$ based graded band gap solar cell structures. The large area multi-layer graded band gap $CuInSe_2$ layers were grown by electro-deposition using simplified two electrode system. Atomic force microscopy (AFM) shows the layers consists of nano- and micro- size particles. Photoelectrochemical (PEC) cell, X-ray photo-electron spectroscopy (XPS) and x-ray fluorescence (XRF) measurements confirm that it is possible to grow $CuInSe_2$ layers with p-, i- and n- type electrical conduction, as pre-determined for application in multi-layer device structure. XRF, XPS and PEC measurements show that Cu-richness provides p-type conduction and In-richness provides n- type conduction in electrodeposited $CuInSe_2$ layers. It is possible to grow materials with different band gaps in the range 1.00 – 1.90 eV. The combination of these two properties allows growth of multi-layer structures and exhibit photovoltaic activity.

A) Photoelectrochemical Solar Cells

Photoelectrochemical (PEC) solar cells are cost effective and convenient for harvesting solar energy. Here, a semiconductor photoelectrode dipped in electrolyte provides necessary charge transfer to obtain photo-voltage or photo-current. Use of multilayered photoelectrode in PEC cell can also improve the performance of the cell.

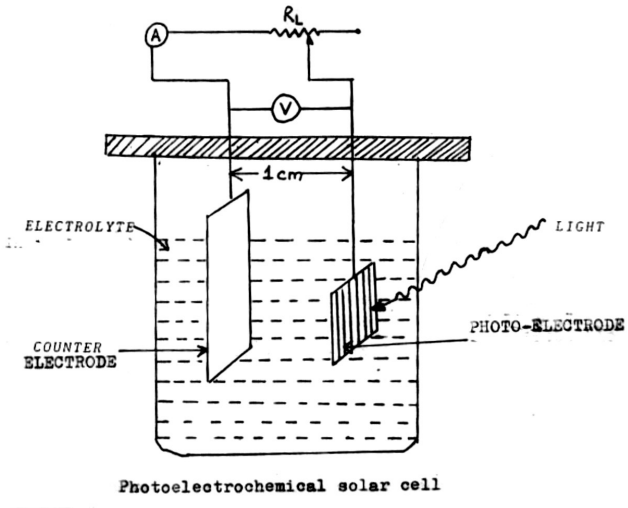

Fig. 4 Setup for PEC Measurements

Aloney et.al.[6] have reported CdSe/ZnSe double layered photoelectrodes in PEC cells. The photoelectrodes were prepared by electro-co-deposition of CdSe and ZnSe films on titanium (99.9%) substrate from an aqueous acidic electrolyte $CdSO_4$ (0.1M)/SeO_2 (0.3M) and $ZnSO_4$ (0.1M)/ SeO_2 (0.3M) and H_2SO_4 (0.5M) respectively. First CdSe was deposited and then ZnSe was deposited over it. The current density was kept 10mA/cm^2 and deposition time duration was 60/60 minutes. The photovoltaic effect was studied using a semiconductor/liquid rectifying contact obtained by dipping photoelectrode in polysulphide electrolyte consisting of ($NaOH/Na_2S/S$) each 1M. A conventional two electrode configuration for PEC cell is used with graphite as a counter electrode. (Fig.4)

Fig.5 shows the photovoltaic output characteristics of photoelectrodes prepared by electro-co-deposition of CdSe, ZnSe and CdSe-ZnSe. The cell parameters are given in Table I [7]. It is clearly observed that ZnSe gives very poor performance with efficiency $\eta = 5\%$; because of its large band gap only small portion of the light spectrum is utilized to generate electron and holes. CdSe shows better results with $\eta = 15\%$ but a double layer of CdSe/ZnSe of same thickness gives much higher values of cell parameters and an efficiency of 40%. Multi -band gap layers of different semiconducting materials convert larger portion of optical energy into electricity.

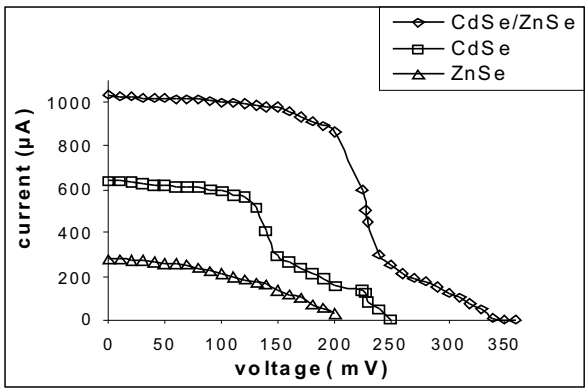

Fig.5: Output curves for single and double layer films of CdSe and ZnSe.(Ref.7)

Table I. Cell parameters for CdSe, ZnSe, CdSe/ZnSe layers (Ref.7)

Sample	Current Density (mA/cm^2)	V_{oc} (mV)	I_{sc} (mA)	Power Output $10^{-6}(mW/cm^2)$	Fills Factor %	Efficiency (? %)
CdSe	10	250	0. 640	67560	42	15.8
ZnSe	10	210	0.280	21450	38	5.0
CdSe/ ZnSe	10	360	1.031	171737	55	40

A) Organic Solar Cells

Interest in organic solar cells stems primarily from the promise of ease of processing. This is because, to date, many organic solar cell devices have used polymers as integral parts of their construction. For example, conjugated polymers often participate as electron donors and hole conductors in the active layer of organic solar cells. Since the science of polymer processing is well-developed, it is hoped that one day conventional processing steps, such as roll-to-roll processing and doctor-blading can be employed to make large area, inexpensive organic solar cells on flexible substrates. Such flexible cells could be used in countless ways, from handheld electronics to commercial power production. In the last years, the use of organic materials as active layer in photovoltaic device has attracted more and more attention, and the total conversion efficiency of those cells has increased rapidly. [8]

Several approaches for organic tandem (multiple) cells have been reported in the last decade, depending on the materials used for the active layer and the proper separation or recombination layer(s) [9]. All layers can be different in each architecture or approach. In general, the multiple organic solar cells can be divided in three classes:

A) Tandem (or multi-junction) organic solar cells in which low-molecular-weight molecules are used for both the bottom (front) and the top (back) cells.

B) Hybrid tandem organic solar cells in which the bottom cell is processed from polymers by solution-processing while the top cell is made of vacuum-deposited low-molecular-weight molecules.

C) Fully solution-processed tandem or multi-junction organic solar cells in which both the bottom and the top cells are made of polymers.

By using two (or more) donor materials with non-overlapping absorption spectra in a tandem or multi junction structure, the whole visible range of the solar light can be absorbed and even extended into the near infrared region. In the addition to covering a large part of the spectrum, tandem solar cell offer the distinct advantage that

photon energy is used more efficiently because the voltage at which charges are collected in each sub-cell is closer to the energy of the photons absorbed in that cell. In the various tandem structures the layer that separates both sub-cells plays a very important role.

Yakimov and Forrest [10] presented the first multiple-heterojunction solar cells by stacking two, three, or five vacuum-deposited ultrathin organic bilayer photovoltaic cells in series.

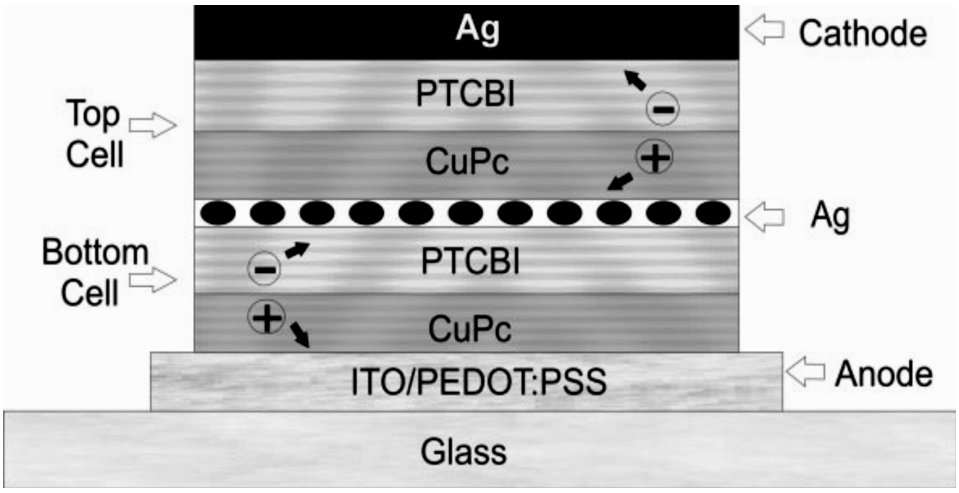

Fig. 6 The structure of an organic tandem solar cell based on the small molecules CuPc (donor) and TCBI (acceptor). The 0.5 nm Ag separation layer provides recombination sites for the free charges arriving from the bottom and top cell.(Ref.10)

All single thin hetero-junction cells (bottom and top cell) are made of Cu-phthalocyanine (CuPc) as a donor and 3,4,9,10-perylenetetracarboxylic bis-benzimidazole (PTCBI) as an acceptor. The device is processed on an indium tin oxide (ITO) substrate covered by 30nm poly (ethelenedioxiythiophene): polystrenesulfonic acid (PEDOT: PSS), which serves as anode of the device. The sub-cells are deposited by thermal evaporation in vacuum of ~10^{-6} Torr, starting with donor material (PTCBI). A thin layer of silver clusters (0.5 nm) is deposited between the two sub-cells as recombination layer and finally 80nm Ag is thermally deposited for the cathode of the device (Fig.6).

After absorption of the incident light in such a structure, excitons are created in both the donor (D) and acceptor (A) material. Only excitons that are created very close (in range of the exciton diffusion length, 10nm) to the D/A interface can be separated into charges. Then, the electrons and the holes travel through the acceptor (PTCBI) and donor (CuPc) layers, respectively, to the contacts of the device. The holes of the bottom cell and the electrons of the top cell are extracted from the device; where as the electrons of the bottom cell recombine with the holes of the top cell at the metallic interlayer (Ag nanoclusters).

The recently developed multi-junction photovoltaic cells with optimized materials and thickness lead eventually to higher efficiencies as compared to single layer solar cells [9]. Recently power-conversion efficiencies of more than 6% have been achieved using solution-processed organic bulk hetrojunction tandem solar cells. The realization of working organic tandem and multi-junction photovoltaic cells is an important step forward to the improvement and finally commercialization of large-area organic solar cells.

1) NANOSREUCTURED SOLAR CELLS

Semiconductor nanoparticle, nanowires, quantum wells or other nanostructures are found to exhibit peculiar characteristics due to surface effect and quantum confinement effect. An important property is the increase in effective band gap by reducing the size in nanometer range. Nanostructures have been used to improve charge collection efficiency in solar cells, to demonstrate carrier multiplication and to enable low-temperature processing of photovoltaic devices.

The quantum well (QW) solar cells are based on the principle that by suitable choice of various widths and depths of QWs [11], the absorption can take place at the different energy levels thereby reducing thermalization losses. In the QW solar cells the photocurrent and output voltage can be individually optimized, because the absorption edge and spectral characteristics can be tailored by the width and depth of QWs, while the output voltage is still primarily determined by wider band gap bulk material.

Barnham and Duggan [12] have discussed high efficiency multi-band gap solar cells using AlGaAS/GaAs/InGaAs multiple quantum well and superlattice systems as absorbers in concentrator solar cells. By adjusting the quantum well width, an efficient band gap variation that cover high efficiency region of solar spectrum can be obtained. Suitable structures to ensure good carrier separation and collection and to obtain higher open circuit voltage have been presented using III-V semiconductor multi-layers. Efficiency achieved is above existing single layer with upper limit in excess of 40%.

Arountionian et al [11] have described the concept of quantum dot (QD) solar cells. They have presented a theoretical model for a practical p-i-n QD solar cell built on the base of self organized InAs/GaAs system. It has been observed from the computed data that the conversion efficiency of p-i-n structure can be significantly increased by insertion of self-organized QD multi-layers into the intrinsic region. This concept may be useful for the fabrication of high efficiency tandem solar cells.

Dongre et al [13] have studied photovoltaic effect using multi-layers of nanostructured CdS on titanium substrate in PEC cells. For the synthesis of multiple band gaps photo-electrode of CdS, three layers of CdS nanostructures having different effective band gaps were prepared separately as well as one over other multi-layered structure by chemical bath deposition (CBD) technique followed by chemical etching [14].

The first layer of CdS film was chemically deposited onto the substrate from an alkaline bath (pH~ 12) containing 1M each of $CdSO_4$ and thiourea, at a temperature of 80 °C and a deposition time of 35 minutes. The freshly prepared films were etched in dilute hydrochloric acid at room temperature (27^0C) and then heat treated at 100^0C for an hour.

The second layer of CdS was prepared from similar aqueous alkaline bath (pH~12) onto the first layer with deposition time 20 minutes, at a temperature of 60^0C. Chemical etching of the as-grown sample has performed in dilute hydrochloric acid at 60^0C. After etching such a film shows flower-like structure of CdS. This double layer of CdS was heat treated at 100 ^{0}C for an hour.

The third layer of CdS was prepared onto double layer of CdS from similar aqueous alkaline bath (pH~12) with deposition time 5 hours, at room temperature (27^0C). The substrate coated with clusters of CdS nanoparticles was immersed immediately in dilute hydrochloric acid at low temperature (10^0C) in order to obtain nanowires. Finally, the whole sample (triple layer) was heat treated at 100^0C for an hour before characterization and photoelectrochemical (PEC) measurement.

The morphology of the CdS samples was investigated by SEM (Fig.7). It was observed that as grown samples are small grains of spherical shape but wet chemical etching changes them into honeycomb, flower like and nanowire structures.

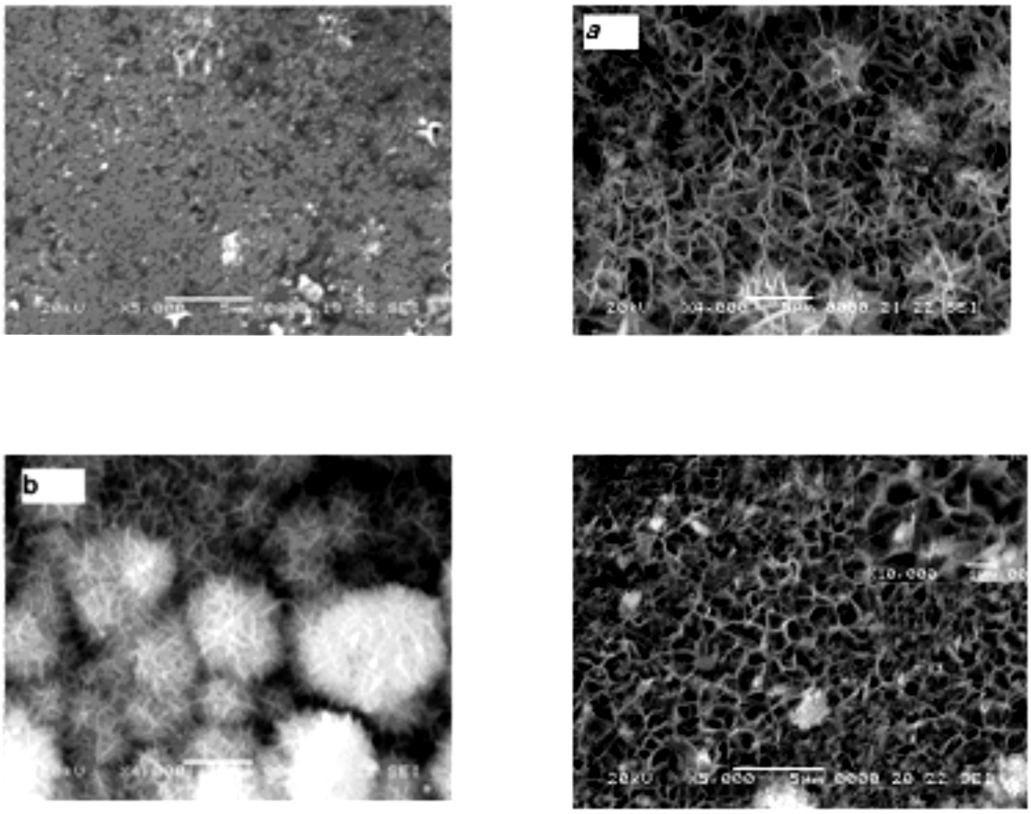

Fig.7 SEM Micrographs of CdS Nanostructures (Ref.14)

Photovoltaic effect was studied in polysulfide electrolyte in conventional configuration for PEC cell. Photovoltaic output characteristics of nanowires, flower-like, honeycomb structure and multiple band gaps photo-electrode of CdS, under the illumination intensity 100 mW/cm^2, are shown in Fig8. The performances of nanowire, flower-like, honeycomb structure and multiple band gaps of CdS PEC cells are summarized in Table II.

Table II. PEC Cell Parameters for Nanostreuctured CdS Photelectrodes (Ref.14)

Photo-electrode	Voc	Isc	F F	Effi. %
Nanowire (NW)	330 mV	181 μA	40	0.024
Flower-like (FL)	270 mV	827 μA	40.8	0.091
Honey-comb (HC)	290 mV	1034 μA	47.49	.142
NW/FL/HC triple layer	470 mV	4977 μA	58.35	1.365

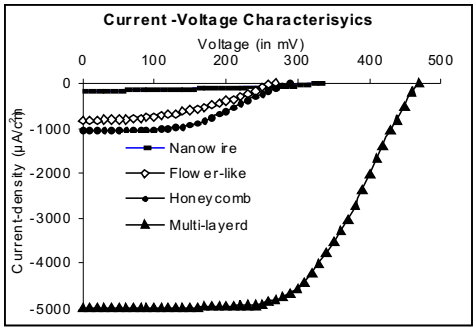

Fig.8. Photovoltaic output characteristics for n-CdS/1M (NaOH-Na_2S-S)/C PEC cells of (a) Nanowire (b) flower-like (c) honeycomb and (d) multiple band gap of all these three layered CdS photoelectrode.(Ref.14)

The short-circuit current density (J_{sc}), open-circuit voltage (V_{oc}), fill-factor and efficiency of the multiple layered CdS PEC cell are much larger than that of all the single layer CdS PEC cells.

The dense networks of nanowires and flower-like CdS are beneficial in terms of direct conduction paths for efficient electron collection. Nanowire, flower-like and honeycomb morphologies provide high porosity for efficient permeability of electrolyte into the inner structure while maintaining a high surface area for enhanced surface activities. This would then promote prompt carrier separation to obtain good collection efficiency.

CONCLUSION

The use of stacked layers in photovoltaic cells is an emerging field. A key factor responsible for the high light absorption efficiency is the multijunction (multilayer) structure. By stacking layers tuned to different absorption frequencies, the cell can absorb the whole spectrum of solar radiation, from far infrared to ultraviolet. Theoretical efficiencies are still much higher than laboratory multijunction efficiencies. And researchers are designing approaches for solar cells with efficiencies greater than 50%, while solar cells with 41% efficiency are likely to be available imminently in large quantities. The impact of high performance on cost of electricity generated by solar concentrators is expected to be significant

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OP - 1

ANALYSIS OF BROADSIDE COUPLED DIELECTRIC IMAGE GUIDE USING MODE MATCHING TECHNIQUE

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Govt. M.V.M, Bhopal, (M.P)

ABSTRACT

The solution of electromagnetic field equations for Broadside coupled dielectric image guide are computed using mode matching technique. Dispersive properties of this guide are plotted for different dielectric materials and with variation in dimensional parameters as a function of frequency. Dielectric materials taken are polystyrene (r=2.56) and Stycast (r=3.4). The Broadside coupled dielectric image guide is very convenient as in this case the dielectric slabs can be bonded to the side metallic walls using some low loss adhesive material. Whereas in the other coupled structure the dielectric slabs have to be supported by some low loss dielectric constant material to maintain the proper distance of side metallic walls from the dielectric slab. As the considered structure is symmetrical it can be analyzed in terms of even and odd modes.

OP - 2

Effect of Grain-Size of Starting Materials on Synthesis of Nano/Micro-Phase Dibarium Nonatitanate Based Dielectric Ceramics.

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ABSTRACT

The polytitanate dielectric ceramic materials based on $Ba_2Ti_9O_{20}$ were obtained by using AR grade titanium dioxide and barium carbonate (purity 99.2%) as starting materials. The starting powder batch was prepared according to the compound stoichiometry (Ba:Ti = 2:9 in molar ratio). The grinding of the starting powder was then carried out for 3, 6, 9 and 12 h in a ball mill having Al_2O_3 as grinding media in acetone. The grain-size measurements were done on resulted powder slurry by means of a Zeta Potential Particle Size Analyzer; Nicomp 380 ZLS. The oxide powders were homogenized, dried and pressed into cylindrical shapes of 12 mm diameter and 10 mm height, using a hydraulic press under 6-8 ton/cm2 pressure. Pre-sintering of samples was carried out in a muffle furnace at 1150^{o}C for 4 h. Then the samples were ground to powders for 6 and 12 h first using agate pastel mortar followed by ball milling. The powders were then prepared for sintering after pressing into a cylindrical form of 12 mm diameter

and 10 mm height. The final sintering was carried out in an electric furnace at 1330°C for 3 h. The cooling of the samples was done slowly at a rate of 10°C/min.

The samples obtained after sintering were characterized from a ceramic point of view (shrinkage, weight loss, absolute and apparent density, porosity etc.) using standard methods. The functional properties of the dielectric ceramic samples, with cylindrical shape of 6 mm in diameter and 4 mm in height, were determined in high-frequency field varying from 2 to 8 GHz by means of a Hioki measuring apparatus with a parallel plate arrangement for Polerizability and Dielectric Constant measurements.

It was found that most promising characteristics of the dielectric ceramics based on $Ba_2Ti_9O_{20}$ were obtained when reagent powders were ground for 9 h, to have particle size in the range of 1 to12 μm. The polerizability and dielectric measurements on these materials showed that the optimized grinding of starting materials resulted in resonant frequency increase by 1.5 GHz, in a band width narrowing by 2.5 MHz. The quality factor is found to improve by 1250 and 1400 for that under load and for that specific to the resonator, respectively, whereas, the loss angle tangent exhibits a decrease by $0.4x10^{-3}$. The variation coefficient versus temperature is found out to be of +20 ppm/oC at the frequency of 8 GHz.

OP - 3

Electrical and Magneto-transport studies of TiO_2 / $La_{0.7}Sr_{0.3}MnO_3$ Bilayers

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ABSTRACT

Recently, hybrid structure of semiconductor – ferromagnetic (FM) oxide materials have fascinated huge curiosity for their efficacy in ever growing demand for spintronics based devices. The character of interface and strain inculcated in the film due to substrate mismatch play a decisive role in formatting the spin injection from ferromagnetic layer into semiconducting oxide layer. In the present study, we report the structural, electrical and magneto-transport properties of epitaxial bilayer of $TiO_2/La^0.7Sr_{0.3}MnO_3$ (LSMO) on c-$LaAlO_3$ (LAO) and c-$SrTi_{O3}$ (STO) substrates deposited by pulsed laser deposition. In-plane epitaxy of the bilayer was confirmed by performing in plane phi scan x-ray diffraction. Four probe resistivity measurements revealed metal-insulator transition temperature (TMI) at ~ 290 K for bilayer deposited on LAO substrate, whereas, bilayer deposited on STO substrate showed TMI higher than room temperature. These bilayers on LAO and STO substrates also reveal low temperature resistivity minima at 67 K and 47 K respectively, which do not vary even on application of 8 Tesla magnetic field. Interestingly the resistivity behaviour of these bilayers reveals hysteresis behaviour depending on the protocol used for cooling and heating in unequal field, though hysteresis effect being lower for film on LAO than on STO substrate. These bilayers demonstrate a rectifying behaviour, consistent with p- type carriers in LSMO and n- type carriers in TiO_2 layers. Strikingly, the rectifying behaviour of the bilayers shows a negative magneto-resistance effect on application of magnetic field in the studied temperature range of 5 K to 300 K, in contrast to positive magneto-resistance in previously reported similar bilayer structures. We discuss the observations in light of juxtaposition of different FM and metallic nature of LSMO, different character of strain imposed due to different substrates and the quantum interference effects due to weak localization at low temperature.

OP - 4

Structural study of ZnO nanorods grown by aqueous and non-aqueous synthesis techniques

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ABSTRACT

Nanostructured films with controlled architectures are desirable for many applications in optics, electronics, biology, medicine, and energy/chemical conversions. Low-temperature, chemical routes have been widely investigated for the synthesis of continuous films, and arrays of oriented nanorods. Chemical routes to metal oxide nanoparticles in organic solvents under exclusion of water have become a versatile alternative to aqueous methods. We focus on the preparation of well aligned ZnO NPs/NR arrays using zinc salts through both aqueous and non-aqueous chemical route synthesis techniques, where ZnO nanostructured materials have been grown on glass substrates. In aqueous-phase synthesis technique ZnO nanorods have been directly grown on substrate with diameter in the nanoscale regime can be grown in an aqueous solution using zinc nitrate and hexamethylenetetramine (HMT) in equimolar ratio, whereas through non-aqueous solution we observed a patterned growth of ZnO nanorod arrays over the seeded substrate under the influence of heat-treatments using Zinc acetate dehydrate as a precursor, diethanolamine and 2-mithoxyethanol. Our work provides a systematic study of controlled morphology and crystallinity of ZnO nanorod arrays. The investigation demonstrates that the synthesis process conditions of ZnO thin film have strong influences on the morphology and crystallinity of the ZnO nanorod arrays grown thereon, where non-aqueous process offers the possibility of better understanding and controlling the reaction pathways on the molecular level, enabling the synthesis of nanomaterials with high crystallinity and well-defined, uniform particle morphologies. Here the annealing temperature also plays an important role on the growth of nanostructure of the ZnO grains and nanorod arrays. The scanning electron microscopy (SEM) image and X-Ray diffraction (XRD) data reviles that the growth of ZnO nanorod arrays is highly patterned hexagonal (wurtzite) structures growing along the c-axis perpendicular to the substrates.

Keywords: Zinc Oxide; Nanorod arrays; Hexamethylenetetramine (HMT); Scanning Electron Microscope (SEM); X-Ray Diffraction (XRD); Fluorescence Spectroscope.

OP - 5

Optical phase conjugation by stimulated Brillouin scattering in semiconductors: effect of quantum correction

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ABSTRACT

In recent years, application of nonlinear optical effects based on field induced indices such as optical phase conjugation (OPC) and optical bistability have attracted a great deal of attention. Phase conjugation is used to correct distortions on optical beams that arise from propagation through non-ideal optical media, such as the atmosphere or low quality optical components. Several types of nonlinear interactions have been used for phase conjugation, including degenerate and nondegenerate four-wave mixing, stimulated Brillouin scattering (SBS), Brillouin enhanced four-wave mixing and stimulated Raman scattering. An important advantage of OPC-SBS over others is that optical phase self conjugation is realized in this method. Using quantum hydrodynamic model (QHD) present analysis establishes the possibility of optical phase conjugation in semiconductors. The minimum cell length required for OPC to occur has been determined. Effect of Bohm potential on the phase conjugate reflectivity is studied through the quantum corrections in classical hydrodynamic equations. The analysis also deals with the qualitative behavior of phase conjugate reflectivity in presence and absence of quantum corrections. Quantum corrections are found to augment phase conjugate reflectivity through modified OPC-SBS process. The main utility of the analysis is in establishing the potential of quantum correction through Fermi temperature and Bohm Potential terms.

OP - 6

Pressure induced structural phase transition in Tantalum Carbide

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ABSTRACT

In this research paper we have explored the structural phase transition and elastic properties of tantalum carbide (TaC) compound. Phase transition pressures are associated with a sudden collapse in volume showing the incidence of first order phase transition. At ambient condition the present compound exhibit in rock salt (NaCl) structure, it transforms in caesium chloride (CsCl) structure under high pressure. The phase transition pressures and associated volume collapses obtained from present potential model show a generally good agreement with the available literature. The elastic constants and bulk modulus are also reported for the present compounds.
Key words: Carbides; Phase transition; High pressure; Volume collapse; Elastic property.

OP - 7

Ionospheric Scintillation Studies using GPS measurements during March 2008

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ABSTRACT

Analysis of GPS ionospheric scintillations during 7-27 March 2008 from HIMADRI (78.95º N, 11.93º E), Ny Alesund, Arctic located in the vicinity of the daytime cusp and under the polar cap on the night side and MAITRI (70.76º S, 11.74º E), Antarctic a sub auroral location during magnetic quiet conditions (ΣKp<10), but with increasing strength of magnetic disturbance it attains an auroral position, is presented in this paper. Data is collected by GPS Ionospheric and Scintillation Monitor (GISTM) GSV4004A receiver. It is found that phase scintillation is highly sensitive during the magnetically disturbed conditions. Percentage occurrence of phase scintillation is well correlated with the geomagnetic activity during the observation period. As the solar activity increase the scintillation activity also tend to increase which results more loss of lock of satellite signal. Frequent losses of lock were observed in Arctic region than in Antarctic region.

Keywords: GPS; Scintillation; Geomagnetic activity.

OP - 8

Investigation of Transport Properties of Perovskite Manganites

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ABSTRACT

Transport properties of perovskite manganites such as $PrMnO_3$, $Pr_{0.5}Ca_{0.5}MnO_3$ and $Pr_{0.5}Ca_{0.5}Mn_{0.97}Cr_{0.03}O_3$ in the temperature range of 0 K ≤ T ≤ 200 K have been investigated by us for the first time using modified rigid ion model developed by us and found that the our computed results on transport properties follows the same trend as that of available experimental values. These are technologically important materials with orthorhombic perovskite-like structure and space group Pbnm. These materials have been the subject of major research interest owing to the intriguing underlying physics and the anticipated multifunctional and advanced applications for the next generation electronics.

Keywords : Transport properties, Perovskites, Specific heat, Debye temperature, Cohesive energy.

OP - 9

EXAFS studies at the Cu K-edge in some copper complexes

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ABSTRACT

X- ray absorption spectra have been recorded at the Cu K-edge in six copper complexes. The complexes have benzimidazole as primary ligand and Cl, Br, $1/2SO_4$, ClO_4, NO_3 as secondary ligands. The spectra have been recorded at the dispersive EXAFS beamline BL-8 at Indus-2 Synchrotron, Raja Ramanna Centre for Advanced Technology, Indore. Benzimidazole is extensively used in industrial processes as corrosion inhibitor for metal and alloy surfaces particularly that of copper. In the present paper, we have studied extended X-ray absorption fine structure (EXAFS) at the Cu K-edge in these complexes. The spectra have been analyzed by Fourier transform technique and structural parameters have been determined.

OP - 10

Thermally stimulated depolarization current and ultraviolet spectroscopy studies in pure and Malachite green sensitized Polyvinyl chloride films.

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ABSTRACT

The mechanism of thermally stimulated depolarization current (TSDC) in pure and Malachite green sensitized Polyvinyl chloride samples sandwiched between similar aluminum electrodes have been polarized at temperature 90°C with polarizing fields 20, 30, 40 and 50kV/cm. The samples were prepared by the casting from

solution technique whose thickness measured around 30μm. Two peak current maximum found at 63±8 and 138±7°C for pure and 7.5% **s**ensitized PVC samples, while for 15% sensitized sample one peak was measured around 56°C in positive direction and the other peak near about 140°C in the negative direction. The TSDC spectra have been use to calculated activation energy by initial rise method .The calculated activation energies are 0.372-0.714ev for pure PVC and 0.298-0.987ev for sensitized PVC samples. The magnitude of peak current increases with polarizing field, Dipolar, Space charge and Charge Transfer Complexes mechanisms may be responsible for this nature. Charge Transfer Complexes is also clarify by the Ultraviolet Visible spectrum of pure and sensitized thin film.

Key words : Thermally stimulated depolarization current (TSDC), Ultraviolet Spectroscopy, Pure and sensitized Polyvinyl Chloride, Casting from solution technique, Dipolar, Space charge and CTC`S Mechanisms]

Thermo Luminescence Comparative Studies of γ- Irradiated $BaMg\ Al_{10}O_{17}$ doped with Transition Metal

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ABSTRACT

In the present paper is the study and investigation of FTIR and TL for substrate of transition metals Mn and Cu. Using the Combustion synthesis at 500°C , comparative study have been examined of pure material $BAMgAl_{10}O_{17}$ (undoped) and dopant with Mn, Cu . The XRD study to find out the crystalline of material. the FTIR study indicated that the aluminate group is present and stretch bonding is occur. In the Thermally stimulated luminescence studies were carried out to obtain trap depth., TL behavior and observed glow peaks which is play in important role for dosimeter application and lighting devices.

Key Words: Thermo Luminescence , Fourier Transform Infrared Spectroscopy, dosimeter.

High Pressure Structural Phase Transition and Elastic Properties of Lutetium Chalcogenides

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ABSTRACT

Pressure induced structural phase transition at high pressure, elastic constants and variation of elastic constants with pressure for LuX (X = S, Se, Te) compounds have been studied theoretically by using an interionic potential theory with modified ionic charge introduced to include the Coulamb screening effect due to localized f-electrons. These compounds undergo structural phse transition from B1 to B2 phase at high pressure ranges from 10 to 60 Gpa

Determination of relative quantities of different species by X-ray absorption spectroscopy

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ABSTRACT

The relative quantities of the different species in a given sample can be determined *by X-ray absorption spectroscopy.* In the present work, we have taken an example of a mixture of cuprous oxide (75%) and cupric oxide (25%) and recorded the X-ray absorption spectra at the copper K-edge for the mixture and the two standards separately. The relative positions of the X-ray absorption edges have been used to determine the percentages of cuprous oxide and cupric oxide in the mixture. The results obtained have been found to be comparable with the 'as prepared' composition. The results obtained by the present method have also been compared with those obtained by two other methods, used by us earlier, for finding the percentages of species in the mixture. These two methods are also based on *X-ray absorption spectroscopy* and are called linear combination fitting (LCF) method and normalized difference absorption edge spectra (NDAES) analysis method.

Lattice Dynamics of $(ND_4I)_{0.42}(KI)_{0.58}$

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ABSTRACT

When the tetrahedral ND_4^+ molecules in deuterated ammonium iodide are statistically diluted by spherical K^+ ions, the mixed crystals $(ND_4I)_x(KI)_{1-x}$ exhibit an orientational glass state at low temperatures. In the dynamically disordered phase, distortions are introduced due to non-equivalence of N-D bonds, which induce elastic quadrupolar moments of ND_4^+ in $(ND_4I)_x(KI)_{1-x}$ mixed systems. This theoretical approach is motivated from the coherent inelastic neutron scattering investigations of phonon dispersion curves for composition x=0.42 at room temperature**.** We have applied Extended Three Body Force Shell Model (ETSM) to calculate phonon frequencies of orientationally disordered $(ND_4I)_{0.42}(KI)_{0.58}$ in symmetry directions q00,qq0 and qqq at 300K . Our results are in good agreement with the experimentally observed TA phonon frequencies at room temperature. It is interesting to note that the anomalous softening occurring in the phonon frequencies is reproduced well by the ETSM results. This implies that ETSM formalism properly incorporates the TR coupling effects in $(ND_4I)_x(KI)_{1-x}$ mixed crystals which is responsible for the anomalous behavior of TA phonons.

Economic importance of condensed matter

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ABSTRACT

Condensed-matter and materials physics is the branch of physics that studies the properties of the large collections of atoms that compose both natural and synthetic materials. The roots of condensed-matter and materials physics lie in the discoveries of quantum mechanics in the early part of the twentieth century. Because it deals with properties of matter at ordinary chemical and thermal energy scales, condensed-matter and materials physics is the subfield of physics that has the largest number of direct practical applications. It is also an intellectually vital field that is currently producing many advances in fundamental physics.

Fifty years ago the transistor emerged from this area of physics. High-temperature superconductivity was discovered by condensed-matter physicists, as were the fascinating low-temperature states of superfluid helium. Scientists in this field have long-standing interests in electronic and optical properties of solids and all aspects of magnetism and magnetic materials. They investigate the properties of glasses, polymeric materials, and granular materials as well as composites, in which diverse constituents are combined to produce entirely new substances with novel properties.

Condensed-matter and materials physics has played a key role in the technological advances that have changed our lives so dramatically in the last 50 years. Driven by discoveries in condensed-matter and materials physics, these advances have brought us the integrated circuit, magnetic resonance imaging (MRI), low-loss optical fibers, solid-state lasers, light-emitting diodes, magnetic recording disks, and high-performance composite materials.

So with the continous development in his field, it will be used as a comfort of peoples, it means in a commercial level, which will result in the economic development of both area and company.

High Pressure Structural Phase Transition In NpN And CmN

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ABSTRACT

The crystal properties and phase stability of Actinide mononitride AnN (An=Np,Cm) under high pressure have been investigated by using two body inter ionic potential theory with modified ionic charge (Zme) to include Coulomb screening effect. This model is capable of explaining first order phase transition from NaCl to CsCl structure for several rare earth compounds. The values of optimized lattice constant, phase transition pressure, bulk modulus and second order elastic constants agree well with their corresponding experimental data. In order to gain

further information about their mechanical properties, we have also predicted the Young's modulus, Shear modulus, Poisson's ratio (ν), anisotropy factor (A), sound velocities, Debye temperature (θD) and its pressure-dependent behaviour in the B1 phase for the first time.

Keywords : Phase Transition, Mechanical properties of Solids, Debye Temperature.

Fitting of theoretical model to EXAFS spectra recorded photographically

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ABSTRACT

Laboratory X-ray absorption spectroscopic set-ups having low power (0.5kW - 3kW) X-ray tubes and Cauchois-type curved mica crystal spectrographs employing X-ray films as detectors have been in use, since long, specially in many Indian laboratories. Earlier workers have generally analyzed the extended X-ray absorption fine structure (EXAFS) data qualitatively and empirically to yield useful information about molecular structure. The data has also been analyzed through some established relations to yield information about valency, effective nuclear charge, coordination type, average bond length etc. To our knowledge, the data has not been analyzed using Fourier transform and fitting procedures which have now become standard methods of EXAFS data analysis. The aim of the present work is to demonstrate that the commonly available laboratory EXAFS set-ups using photographic method of registration of spectra can also be used for getting structural information from EXAFS spectra by using Fourier transform technique and fitting theoretical model. For this purpose, K absorption spectra of Cu metal foil have been studied as an example. With the help of a microphotometer, the spectra have been obtained in digital form. The background subtracted and normalized experimental data have been first obtained and then the EXAFS data has been Fourier transformed. Theoretical model has been generated and then fitted to the experimental EXAFS data. The different structural parameters have been obtained which are found comparable with the crystallographic data. The present work shows that the photographic method of registration of the EXAFS spectra can also be used for getting structural information at least for the first two coordination shells around the absorbing atom.

Effect of the Structure and Properties of Zinc Stannate Phospher When Embeded with Coir Fibre

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ABSTRACT

Zn_2SnO_4 is known to have high electrical conductivity, high electron mobility and low absorption in visible region of the electromagnetic spectrum. It makes this material suitable for a wide range of applications viz. As a gas sensing material, as anode material for Li-ion batteries and as a photo catalyst for degradation of benzene in an aqueous solution. Its doping this with inorganic material leads to specific changes of their chemical and physical properties.

This paper investigates the change in the properties of zinc stannate when it is doped with unique materials like coir fibre (a natural fibre which is waste product found in abundance in nature). The experimental study shows that there is large change in the structure of zinc stannate when it is doped with organic material. It is well known that coir fibre plays an important role in changing the structural and physical properties of the material. A comparative study shows that when a sample of pure zinc stannate is doped with some other dopents the sample exhibits drastic changes in its physical and chemical properties. This paper investigates the change in the structure (by XRD) and other physical properties such as appearance, hardness, crystalanity. These investigations are expected to pave a way for some other experimental studies for desired properties for some specific materials.

Key words : Electrical conductivity, Li batteries, change in structure, organic doping in inorganic material

Empirical Model for Total Electron Content over Bhopal

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ABSTRACT

An empirical model is developed for TEC using harmonic components up to four orders for the period of March 2004 to February 2008, the descending phase of 23rd solar cycle at Bhopal (23.2˚ N, 77.4˚ E, MLAT 14.2). TEC used in this analysis is obtained by the Global Positioning System (GPS) using the GISTM, GSV4004A at Bhopal, a station near the crest of equatorial anomaly. A set of 81 components of zero and the first four orders were determined using Fourier harmonic analysis and found to be sufficient for modelling the TEC. Modelled TEC values are compared with the observed TEC values along with the international reference ionosphere 2007 (IRI-2007)

model. Results show that maximum deviation of the modelled TEC with observed values is highest during summer (± 20%), less during equinox (± 19%) and least during winter season (± 13%), whereas the IRI-2007 values underestimate the observed values in all seasons during the observation period. The deviation of modelled TEC values is found in excellent agreement with the observed values in the night hours as compared to the day hours, which shows the prominence of the EEJ currents in the equatorial anomaly region during the daytime.

Size Dependent Permanent Dipole Moment of CdSe Nano Crystals : A Theoretical Approach

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ABSTRACT

Abstract. The presence of permanent dipole moment for CdSe nano crystal in the wurtzite crystal structure is analyzed theoretically. Permanent dipole moment of various size CdSe nano crystals have been calculated. Theoretical formulation of dipole moment is based upon the chemical concept of electro negativity. The dipole moment is calculated simply as the product of the magnitude of the effective charge and distance between them. We are explaining the size dependency in CdSe nano crystal by assuming a spherical model of electron distribution and the coulomb interaction i.e potential energy between the charges separated by given distance. Results found are well in agreement with the published data.

Electroluminescence Studies of ZnS : Ag Phosphors and Composites

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ABSTRACT

Electroluminescence of composites is of great importance and may be used for various light emitting device application. The optical and electrical properties of semiconductor-polymer composites strongly depend on their loading and doping. We have prepared the thin films of ZnS:Ag phosphors and their composite in polyvinyl carbazole by using chemical method and studied their electroluminescence. The concentrations of Ag in ZnS:Ag phosphors and in ZnS/PVK composite have been varied. For EL studies, cell were prepared by depositing

ZnS:Ag/PVK composite films on a portion of SnO_2 coated conducting glass plate and taking aluminium foil as a second electrode. It is observed that at particular frequency, the EL emission starts at a threshold voltage and then increases rapidly with increasing voltage. The EL brightness is found to increase with increasing concentration of Ag doping in ZnS:Ag phosphors and also in composites. It is observed from the characteristics that the current varies linearly with voltage, whereas the EL intensity varies non-linearly with increasing voltage. ZnS:Ag/PVK composite shows better EL than ZnS:Ag phosphors.

Numerical simulation of Random lasing in random amplifying medium

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ABSTRACT

The spectral behavior of a random lasing system (TiO_2 powder dispersed in Rhodamine 6 G dye solution) is calculated using numerical calculations. The total integrated intensity and full width at half maximum (FWHM) are calculated for different particle densities and particle size distributions. In addition to that, the power law parameters also calculated as a function of incident optical wavelength, incident optical power, number density of scatterer and size distribution of scatterer. It was seen that the power law parameter also doesn't depend on the pump intensity and emission wavelength, critically and stays approximately constant at 0.71. For smaller particle dimension, photons can travel longer path before scattering thus their path length distribution follows a heavy tailed distribution. At large carrier density, the fluctuation behavior deviates from usual power law and approaches towards Gaussian behavior.

A study on diurnal and seasonal variations in foF2 and M(3000)F2 over low latitude station.

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ABSTRACT

This paper presents an analysis of the variability of ionospheric characteristics (foF2, M(3000)F2) at low latitude station . a study of the variations in the diurnal, seasonal and day to day characteristics of the critical

frequency foF2 and propagation factor M(3000)F2 are studied.The effects of the geomagnetic, activity variations of the F-region parameters over low latitude is also presented.

Keywords : Ionosphere, F-region , critical frequency, ionospheric disturbances, variability.

Modeling of ionospheric electron content at different latitude zones

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ABSTRACT

In this paper we adapt an empirical model for the ionospheric electron content (IEC) at low, mid and high latitude location Learmonth (22^0S-114^0E), Athens (38^0N-24^0E) and Chilton (52^0N-359^0E) during the study period from January 2006 to December 2010.The analyzed results shows that the agreement between modeled and observed value is rather good with maximum deviation limit up to ± 30% at all locations.

Structural, Electronic and Elastic Properties of Nickel Aluminide (NiAl)

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ABSTRACT

The structural, electronic and elastic properties of Nickel Aluminide (NiAl) have been studied using plane wave pseudopotential method (PWSCF) within the local density approximation (LDA). NiAl crystallizes in the CsCl-type structure (B_2 phase). The ground state properties, such as lattice constant (a0), bulk modulus (B_o) and its pressure derivative (B'_o) are determined and compared with available experimental and theoretical results. From the analysis of band structure and density of state, we found that NiAl is metallic in nature. Elastic constants (C_{11}, C_{12}, C_{44}) of NiAl satisfy the stability condition implying that it is elastically stable. We also calculated the shear modulus, Young's modulus, Poisson's coefficient, shear anisotropy factor and Debye temperature of NiAl.

Pressure Induced Structural and Electronic Properties of Plutonium Monophospide: Ab Initio Calculations

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ABSTRACT

The structural, magnetic and electronic properties of plutonium phosphide (PuP) have been investigated using tight-binding linear muffin-tin orbital (TB-LMTO) method within the local spin density approximation (LSDA). Both non-spin-polarized and spin-polarized calculations are performed. We predict a first order structural phase transition from NaCl to CsCl-type structure at a pressure of 42GPa. From energy band diagram it is observed that PuP exhibits metallic behavior. The calculated equilibrium lattice parameter is in good agreement with the experimental and other theoretical work.

Study of Pressure Induced Structural and Electronic Properties of PuAs and PuSb

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ABSTRACT

The pressure induced structural and electronic properties of PuAs and PuSb have been investigated using tight-binding linear muffin-tin orbital (TB-LMTO) method within the local spin density approximation (LSDA). Both non-spin and spin-polarized calculations are performed. We predict a first order structural phase transition from NaCl to CsCl-type structure under the application of pressure range 37 and 21 GPa for PuAs and PuSb, respectively. From energy band diagram it is observed that PuAs and PuSb exhibits metallic behavior. The calculated equilibrium lattice parameters, phase transition pressure and bulk modulus are in good agreement with the experimental and other theoretical results.

Dispersion Characterizations of Microstrip Lines on various Electromagnetic Materials

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ABSTRACT

A simulation model is presented for analyzing the frequency dependent properties of microstrip dispersions with commercially available CAD software. This paper presents an electromagnetic analysis of dispersions in a microstrip transmission lines on various dielectric materials or substrates, for Monolithic Microwave Integrated Circuits (MMICs). The dilemma of understanding materials has concerned scientists for centuries. It is not simple to get a complete picture about what there is behind the surface of material. All material has a unique set of electrical characteristics that are reliant on its dielectric properties. A dielectric material has an arrangement of electric charge carries that can be displaced by an electric field. On the applications of electromagnetic (EM) fields, materials respond in a diversity of ways. The applied electric field would influence both free and bound electrons, while the magnetic field would alter the orientation of tiny atomic moments. Over a particular range of field, these responses are almost linear i.e. is proportional to the applied field. A few examples of such linear, isotropic materials are common dielectrics such as fused silica & glass and common conductors such as copper & aluminum. Dielectric or Electromagnetic materials are approximately always used in Microwave Printed Circuits (MICs) to hold the conductors. The electrical, mechanical, thermal & chemical properties of substrate materials play a significant role in the performance of MICs. The most important electrical properties of dielectrics are permittivity, loss tangent and isotropy. A good microwave substrate should have low loss tangent. When the frequency of a signal electrifying a microstrip is doubled, the phase constant or wave number is not accurately doubled. This type of performance is called dispersions and all microstrip lines are dispersive. The hybrid mode of propagation along microstrip leads to the dispersive mechanism, and is concerns with the changing current and charge distributions in both strip and ground plane as the frequency increases. We have performed a series of SONNET Simulation of a characteristics impedance 50 ohms on a substrates, Rogers RO3003, Arlon 33N, FR4, Alumina and Gallium Arsenide up to a frequency range 30 GHz.

Mechano-Luminescence induced by elastic deformation of II-VI Semiconductors

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ABSTRACT

When the thin film of ZnS:Mn nanoparticles deposited on a glass substrate is elastically deformed by applying a load, then initially the mechanoluminescence (ML) intensity increases with time, attains a peak value Im at a particular time tm, and later on it decreases with time. The rise and decay characteristics of the ML produced

during release of the load are also similar to those produced during the application of load. Similar rise, occurrence of peak and then decrease in ML intensity are also found, when the film is deformed impulsively by dropping a steel ball of small mass from a low height; however, in this case, the time durations for the occurrence of ML and decay time of ML are very short. In the cases of loading and impulsive deformation, after tm, initially the ML intensity decreases at a fast rate and then at a slow rate, in which the decay time of fast decrease is equal to the time-constant for rise of pressure and the decay time for slow decrease is equal to the relaxation time of the surface charges. In the case of loading, the peak intensity Im and the total intensity IT of ML increase quadratic ally with the magnitude of applied pressure; however, in the case of impulsive deformation, both the Im and IT increase linearly with the height through which the ball is dropped on to the sample. In the case of deformation of the samples at a fixed strain rate, Im should increase linearly with the applied pressure. The elastico ML in ZnS:Mn nanoparticles can be understood on the basis of the piezoelectric ally-induced electron detrapping model, in which the local piezoelectric field near the Mn^{2+} centres reduces the trap-depth, and therefore, the detrapping of filled electron traps takes place, and subsequently the energy released non-radiatively during the electron–hole recombination excites the Mn^{2+} centres and de-excitation gives rise to the ML. The equal number of photons emitted during the application of pressure, release of pressure, and during the successive applications of pressure, indicates that the detrapped electron-traps get filled during the relaxation of the surface charges induced by the application and release of pressure because the charge carriers move to reduce the surface charges. On the basis of the piezoelectrically-induced electron detrapping model, expressions are derived for different characteristics of the ML of ZnS:Mn nanoparticles and a good agreement is found between the theoretical and experimental results. The expressions explored for the dependence of ML intensity on several parameters may be useful in tailoring the suitable nanomaterials capable of exhibiting ML during their elastic deformation. The values of the relaxation time of surface charges, time-constant for the rise of pressure, and the threshold pressure can be determined from the measurement of the time-dependence of ML. It seems that the trapping and detrapping of charge carriers in materials can be studied using ML.

Performance Analysis of Metamaterial Based Loaded Electrically Small Microstrip Patch Antenna

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ABSTRACT

Metamaterials are composite or structured material that exhibits electromagnetic properties not found in naturally occurring materials . Metamaterial having negative permeability and permittivity . Its structure consists of split ring resonator (SRR)to produce negative permeability and thin wire elements to generate negative permittivity. These materials have negative refractive index ,due to it group and face velocity appear in opposite direction. These properties of material play a prominent role in designing structures of antenna to improve gain and bandwidth .In this paper,IE3D is used as a simulator to carried out the calculations for S-parameters, quality factor, bandwidth, directivity. comparison has also been made for loaded and unloaded structure.

Study of conduction mechanism in poly (9-vinylecarbazole) pure and doped with ferrocene

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ABSTRACT

Measurement of dc conduction in poly (9-vinylcarbazole) (PVK) pure and doped with ferrocene has been studied. Various mechanism of conduction (Poole-Frenkel, Space-charge limited current, Richardson-Schottky emission, hopping) can cause non-linear characteristics. Analysis the current-electric field dependence proved that the mechanism responsible for conduction in poly(9-vinylcarbazole) doped with ferrocene was bulk limited and Poole-Frenkel mechanism is prevalent. Measuring the dependence of current on electrode material, temperature, field and dopant concentration. The role of doping molecular concentration in the polymer matrix and change in conduction characteristics are studied. Lowering the activation energy due to doping was observed. The conductivity was found to increase with an increase in the ferrocene concentration in the composite.

Keywords : dc conduction, Poly (9-vinylcarbazole), conduction mechanism, activation energy

Non linear Mixing of Two Whistler Waves in the Presence of Density Perturbation of Sound Waves

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ABSTRACT

Whistlers are an important mode of electromagnetic wave propagation in magnetized plasma. The collision less absorption of whistlers in plasma has attracted by wide attention. Currently there is significantly increasing interest in studying the propagation of whistler wave modes in plasma in the presence of magnetic field aligned d. c. electric field.

In this paper, we examine the case of two whistler waves of frequencies (ω_1, K_1) and (ω_2, K_2) and we have studied generation of ω_1-ω_2 and ω_1+ω_2 waves. We have derived the expression for the growth rate of two whistler waves in the presence of electric field. This may explain some non-linear phenomena of whistlers in space and laboratory plasmas. Wave mixing has applications in indirect inertial confinement, fusion, harmonic, generation and wave length conversion.

Spectral response of $MgAl_2O_4$ phosphor doped with $Eu^{3+}$and Dy^{3+}.

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ABSTRACT

Rare-earth doped aluminates emit in a wide spectral region and can be used for a variety of different applications. However a detailed understanding of the mechanism of energy transfer in Eu^{3+}- Dy^{3+} codoped aluminate materials is less studied. In this work we are suggesting the mechanism of energy transfer between Eu^{3+}-Dy^{3+} pair. The photoluminescence studies confirm the theory. Such energy transfer follows the Stokes' shift.
Keywords : Energy transfer, photoluminescence in aluminates. Inter activator-stokes shift, Codoping.

Parametric dispersion and amplification characteristics in direct gap semiconductors

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ABSTRACT

Here, we have reported an analytical investigation of parametric amplification in piezosemiconductors including band structure (BS) and carrier heating (CH) effects. We have used coupled mode scheme under hydrodynamic regime to formulate the second order susceptibility in direct gap semiconductors. We have used energy balance equation to deduce electron temperature which is then substituted in an empirical formula to determine the maximum possible plasma density. Using these parameters we have derived threshold intensity and gain coefficients for InSb, GaAs and CdS crystals. Finally second order susceptibility and parametric gain coefficient have been determined. Extensive numerical estimates have been performed to appreciate the BS effects on parametric amplification process. Present analysis predicts favorable wave vector values to achieve maximum gain. This fact could be utilized for the fabrication of optical parametric amplifiers with appreciable gain. BS and CH effects greatly modify the said process. Suffice it to say that increase in the plasma frequency enhances the parametric gain. CdS is found to be most appropriate host for the parametric amplification with highest gain coefficient. InSb proves its candidature being a cost effective material for fabrication of nonlinear devices, by sacrificing a little towards output.

Growth of Different Phases of Yttrium Manganese Oxide Thin Films By Pulsed Laser Deposition

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ABSTRACT

Recently much attention has been paid to multiferroic thin films for applications into devices such as nonvolatile memories, field-effect transistors and magneto-electric sensors etc. This is because thin films offer controlled way to synthesize multiferroic materials with the possibility of enhancement in magneto-electric coupling. Yttrium manganese oxides (YMO): hexagonal $YMnO_3$ and orthorhombic YMn_2O_5 have attracted considerable attention in this context. Both of these compounds exhibit multiferrocity but the microscopic origins are different [1, 2]. There are reports in which $YMnO_3$ thin films are deposited in hexagonal and orthorhombic pervoskite phase on various substrates but growth of o-YMn_2O_5 phase films is less explored [3,4].

Here we grow thin films of various phases of YMO by pulsed laser deposition from a single h-$YMnO_3$ target and characterize them with various techniques. It is observed that the phase stability and crystallinity of YMO thin films depend on the substrate used and oxygen partial pressure (OPP). (110) oriented and polycrystalline growth of h-$YMnO_3$ are observed on the Al_2O_3 (0001) and NGO (110) substrates respectively, when grown in OPP ≈ 10-6 Torr. While for similar OPP value, growth of mixed phases (h-$YMnO_3$ and o-YMn_2O_5) is observed on Si (001) substrate. Oriented growth of O-YMn_2O_5 phase film on Si (001) substrate is observed first time, when deposited at OPP value of 225 and 350 mTorr. +3 and mixed oxidation states (+3 and +4) of Mn were confirmed by X-ray photoelectron spectroscopy in pure $YMnO_3$ phase and YMn_2O_5 phase respectively

"Study of High-speed solar wind streams and their effects on cosmic ray intensity modulation as well as on geomagnetic activity"

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ABSTRACT

In this study, we have selected the 193 events of HSSWS using the plot of hourly values of interplanetary parameters for the period of 2001 to 2009. Which cover the descending phase of the solar cycle 23. We have selected HSSWS as one having a rapid rising increase in the solar wind speed over a short period reaching a maximum value of ≥ 450 km/s-1, which persist at high values for at least three days after the increase. We have

adopted the Chree method of superposed epoch to determine the average behaviour of cosmic-ray intensity, using the daily mean values of Kiel neutron monitor (154ºN, 114ºW cut off rigidity Re = 2.32 GV) and geomagnetic activity. The result indicates that the flare-generated HSSWS are more effective in producing cosmic ray decreases and the geomagnetic disturbance than the corotating HSSWS.

Effect of Halo Coronal Mass Ejections and cosmic-ray intensity variation

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ABSTRACT

In this study, we have identified 288 halo CMEs events (113, Full halo CMEs and 175, Partial halo CMEs) to show their influence on cosmic-ray intensity for the period of 2001 to 2006, which cover the descending phase of solar cycle 23. We have adopted the Chree method of superposed epoch to determine the average behaviour of cosmic-ray intensity, using the daily mean values of Kiel neutron monitor (154ºN, 114ºW cut off rigidity Re = 2.32 GV). In this study we have excluded those events which are associated with Forbush decreases. The observations obtained from this study indicate that the transient variations in cosmic-ray intensity are effectively produced by coronal mass ejections. Result also shows that the full halo CMEs is more effective in producing depression than partial halo CMEs.

Study on the growth of Zinc Oxide nanorods on Glass and ITO substrates

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ABSTRACT

Highly orientated ZnO nanorods were deposited using aqueous solution method on glass and ITO substrates, it also provides with a basic understanding effect of the base material on the growth of nanorods on both

the substrates. An equimolar aqueous solution of Zinc nitrate and hexamine (HMT) used for the preparation of ZnO nanorods arrays. ZnO nanorods were deposited on glass and ITO substrates to establish the optimal pH and concentration, which yield the best substrate coverage for precursor solution. To achieve uniform growth and highly dense ZnO nanorods, the prepared solution get heated at certain constant temperature. The experimental results have been obtained by using Scanning Electron Microscope (SEM), X-ray diffraction (XRD) and Fluorescence Spectroscope which shows highly oriented nanorods perpendicular to the surface of substrates and a comparative study of ITO and glass grown nanorod arrays shows that the structural chemistry of the substrate clearly affects the as-grown nanostructures. It also clarifies that different type of substrates used as base material favour different kind of planes as suggested in XRD reports. The high variation in optical properties can be attributed to the heating temperatures and limited presence of reactants available for the controlled growth of ZnO nanorods on substrates. Due to the physical limitations in the growth, this kinetically controlled nucleation would be responsible for producing the highly uniform and perpendicularly oriented nanorods.

Keywords : Zinc Oxide; Nanorod arrays; Hexamine; ITO; Scanning Electron Microscope (SEM); X-Ray Diffraction (XRD); Fluorescence Spectroscope.

Modifications in amplitude modulation process in diffusive semiconductors due to hot carriers

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ABSTRACT

For faster signal processing, semiconductors have been the medium of choice because they have lighter carriers those move easily and induce large nonlinearities. One of the important problems in communication system is that of developing effective means for the modulation. Modulation can be achieved with respect to amplitude, frequency, phase etc. The efficiency of amplitude modulation (AM) can either equals or exceeds that of all other modulation processes. In communication, AM is very helpful to save power by using single band transmission. In the present paper, analytical investigations are presented for the AM/demodulation of an electromagnetic wave in magnetised diffusive semiconductor incorporating carrier heating (CH). The consideration of CH effects adds new dimension to the present analysis. This problem is analyzed in different wave number regimes over a wide range of cyclotron frequency. It is found that incorporation of CH effects effectively modifies the AM/demodulation process favourably. Complete modulation and demodulation of wave takes place in all possible wavelength regime when carrier frequency is equal to cyclotron frequency. It has also been seen that when

Wave-like disturbances in the F-region Critical Frequency at equatorial location

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ABSTRACT

Traveling ionospheric disturbances are observed as small scale fluctuations in critical frequency and are caused by the interaction of upward propagation gravity waves with the ionosphere. In the present paper some preliminary results obtained on the small scale fluctuations in foF2 at Kwajelin (9^0N-167^0E) using 5-minute interval data during low to moderate solar activity period i.e. from January 2006 to December 2010 at storm time is considered and the analyzed results also compare with quiet days. Spectral analysis in the present paper for small scale TID's shows the fluctuations to contain dominant periods in the range 5-60 minute.

Investigation On The Nonlinear Spin-spin Interaction On The Matal-magteic Interlayer Of Multi Layer Structure.

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ABSTRACT

Every magnetic system has a unique characteristic property defined by its dimension, namely micro or nano structure. This includes nucleation, spin polarization, rotation, accumulation and transportation on a quantum phenomenal account, even in single domain particle.

We have investigated the nonlinear excitations in a magnetic multilayer, namely, a spin valve pillar, during the propagation of electromagnetic wave. A spin valve pillar consists of a non-magnetic, conductor layer sandwiched between two ferromagnetic layers, one a thick layer with fixed magnetization, and another a thin layer with flipping magnetization. The electron flow across the structure, exhibit spins transportation effect due to the torque experienced by the spin magnetization.

We have modeled the interaction in the magnetic multilayer structure, by writing the Hamiltonian of the system and have studied the effect of perturbation using multiple scale expansion and Reduction Perturbation Method.

The Landau-Lifshitz-Gilbert equation of magnetization is modified, with the inclusion of the spin transfer

torque term, along with the conventional precession and damping term, to fit the physical structure of the system.

The evolution of magnetization of the ferromagnetic layer is studied along with Maxwell's equation for the electromagnetic waves. It is found that the system of equations reduce to the celebrated modified KdV equation.

The solution of the spin excitations are localized 'Solitons', which is the never diminishing nonlinear wave, which can be harnessed to the increase in density of memory devices and to drive out the noise created within..

Effect of Suspended Particles on Klvin-Helmholtz Instability in Porous Medium

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ABSTRACT

The Kelvin-Helmholtz instability of a plasma is considered in the porous medium with suspended dust particles. The medium is assumed to be incompressible. The linearized hydromagnetic equations are solved and a dispersion relation for such a medium has been obtained using appropriate boundary conditions. We find that the dispersion relation is modified due to the simultaneous presence of porosity and suspended particles. A stability criterion for the medium is derived, which is found to be independent of the presence of the suspended particles. Similarly condition of instability of the system is also derived

Effect of Magnetic Field on Rayleigh Taylor Instability of Fluids Streaming in Porous medium

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ABSTRACT

The Rayleigh-Taylor instability of a plasma is considered in the porous medium with variable horizontal magnetic field. The medium is assumed to be incompressible. The linearized hydromagnetic equations are solved and a dispersion relation for such a medium has been obtained using appropriate boundary conditions.

We find that the dispersion relation is modified due to the simultaneous presence of magnetic field and porosity. A stability criterion for the medium is derived, which is found to be depend on the magnetic field. Similarly condition of instability of the system is also derived.

First Principle Study of Phase Transition in $HgAl_2Se_4$: a Defect Chalcopyrite Compound

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ABSTRACT

$HgAl_2Se_4$ is a ternary semiconducting compound, crystallizes in defect chalcopyrite structure within I-4 space group at ambient conditions. A pressure induced structural phase transition from body cantered tetragonal (BCT) to spinel phase has been confirmed. The lattice constants, equilibrium volume, Bulk modulus and its pressure derivative for both the phases are found to be in excellent agreement with the available experimental results.

Study of Polarisiability on YbSb under High Pressure

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ABSTRACT

We have investigated the pressure volume relationship; pressure induced structural phase transformation in Ytterbium antimonide compound (YbSb) for the first time by using new improved interaction potential model (IIPM) which includes Coulomb interaction, three body interaction, Polariziability effect and Overlap repulsive interactions. The calculated pressure and relative compression reveal that this compound shows a B1-B2 phase transition. We have also calculated the elastic property and pressure derivatives of YbSb.

Various Applications Of Nanomaterials

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ABSTRACT

Nanotechnology is a branch of science that deals with structures of 1 to 100 nm in scale. The small size, surface tailorability, improved solubility, and multifunctionality of nanoparticles open many new research avenues

for biologistsand their novel properties offer the ability to interact with complex biological functions in new ways. This rapidly growing field allows cross-disciplinary researchers the opportunity to design and develop multifunctional nanoparticles that can target, diagnose,and treat many dangerous diseases. Now a days nanomedicine has emerged as a large subject area and includes nanoparticles that act as biological mimetics (e.g. functionalized carbon nanotubes), 'nanomachines', nanofibres and polymeric nanoconstructs as biomaterials, and nanoscale microfabrication- based devices, sensors and laboratory diagnostics. The applications of nanotechnology in bioimaging and detection, drug delivery, drug discovery and new drug therapies have declared war on cancer and other dreadful diseases. Molecular imaging techniques can be used as useful adjuncts in the development of nanomedicine and in personalizing treatment of patients. Scientists working in the area of nanoscience strongly believe that the merger of nanoscience and biotechnology will undoubtedly transform the foundations of disease diagnosis, treatment and prevention in the future. Recent literature focuses on the potential of nanomedicine, including the development of nanoparticles or diagnostic and screening purposes, DNA sequencing using nanopores, manufacture of drug delivery systems and single virus detection, and in the emergence of nanoneurosurgery. Some important examples of nanoparticles used in biological research are dendrimers, nanoparticle passive,ceramic nanoparticle and magnetic nanoparticles are used for targeting of cancer cells. Nanoparticle-aptamer bioconjugate for targeting of prostate cancer cells.Anti-Flk antibody-coated 90Y nanoparticles are used for antiangiogenesis therapy drug delivery, imaging, boron, neutrons capture therapy.Gold and silicon nanoparticles for breast cancer therapy, quantum dots for tissue imaging, silicon-based nanowires and chip based biosensors for real-time detection and titration of antibodies,virus detection. Carbon nanotubes for bone grafting, biosensors, bacteria and virus filtration. Silver nanoparticles are used for antibacterial agents and filters. Biologists in collaborations with Physicists are using this innovative technology to overcome boundaries common to cell biology and clinical medicine. Nanotechnology used in biotechnology is definitely a life-saving innovation that has come as a boon to mankind.

Study of Large Forbush Decrease and Their Association with Interplanetary and Geomagnetic Parameters

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ABSTRACT

Forbush decrease (FD) are characterized by a rapid decrease (within a few hours) in cosmic ray intensity (CRI) followed by a slow recovery, typically lasting several days at 1AU near earth regions [1]. We have studied large Forbush decrease (FD) magnitude ≥8.00% observed by grounded based neutron monitor at Oulu during the

period of 2000-2006 and association of FD with coronal mass ejections, interplanetary shocks, magnetic clouds and geomagnetic storms. We have found that all the large Forbush decreases are associated with coronal mass ejections, majority of them are halo coronal mass ejections (H-CMEs) which are related to Forbush decreases, are associated with strong solar flares of category X, M and C classes. We have observed that majority of the Forbush decreases are associated with interplanetary shocks and they are forward shocks. The interplanetary shocks which are related to Forbush decreases, more than 50% of them are related to magnetic clouds and majority of the magnetic clouds are of excellent or good quality. We have found that intense Forbush decreases which are associated with halo coronal mass ejections (HCMEs), are also associated with intense geomagnetic storms. we have associated large Forbush decreases with halo coronal mass ejections, interplanetary shocks, magnetic clouds and geomagnetic storms for the period 2000-2006 and an attempt has been made to know the role of halo coronal mass ejections, their interplanetary manifestations in producing large geomagnetic storms and Forbush decreases in cosmic ray intensity .It is concluded that halo coronal mass ejections (H-CMEs) associated with X-ray solar flares and related to interplanetary shocks, magnetic clouds or combination of both are mainly responsible for large Forbush decreases and geomagnetic storms in earth magnetosphere.

Study of Seismic Event and Sunspot Number

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ABSTRACT

In this study we analyzed seismic event and sunspot number. Data of seismic event and sunspot number collected from national geophysical data centre Result of the Study shows that seismic event increased with sunspot number. It may be due to the huge amount of solar energy strike earth and hence plate disturbance occurred.
Keyword: Sunspot number, plate disturbance, seismic event.

Transition assignments to the Lγ2.3′ satellite

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ABSTRACT

The satellite Lγ2.3' has been observed on the high energy side of the unresolved doublet Lγ2.3 and has been reported in the elements from 40Zr to 47Ag and from 57La to 63Eu. Earlier workers have ascribed the origin of this

satellite to the transition L_1M_x - $M_xN_{2,3}$ on the basis of energy consideration alone. In the present work, intensity calculations have also been done and theoretical satellite spectra have been computed. The probability of conversion of single hole K state to double hole state L_1M_x has been calculated through Coster-Kronig transition (K - L_1M_x). The probability of creation of double hole state L_1M_x through shake off process has also been calculated. The total probability of creation of L_1M_x double hole state is found out by taking the sum of Coster-Kronig probability and shake off probability. This total probability has been statistically distributed among all the allowed transitions from this set of levels. A composite spectrum formed by spectral lines emitted by the 24 transitions has been computed by taking each transition as a Gaussian line. Theoretical spectrum is thus obtained and compared with the available satellite energy data and the transitions giving rise to the satellite have been identified.

Structural and Transport Properties of Ruthenium doped Yttrium Manganite

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ABSTRACT

A systematic study on the effect of Ruthenium (Ru) doping in $YMnO_3$ has been undertaken. Polycrystalline sample with composition $YMn_{1-x}Ru_xO_3$ (x= 0.02) was synthesized by using conventional high temperature solid state reaction method. The structural and transport properties of the prepared sample have been carried out in the wide range of temperature. Our XRD and Rietveld analysis reveals the single phase formation of the reported compound in hexagonal structure with space group P63cm (JCPDS: 25-1079). The observed pointed kinks in the specific heat study are symptomatic of the probable coupling in between the electric and magnetic orders. The low temperature study shows independence of specific heat on magnetic field at 8T. The detailed investigations of conduction mechanism in $YMn_{0.8}Ru_{0.2}O_3$ compound has been carried out in the wide range of temperature which shows an abrupt enhancement in the resistivity below the magnetic transition.

Keywords : Specific heat, XRD, AFM ordering.

Photovoltaic effect of double layered CdSe/ZnSe photo-electrode in PEC solar cell

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ABSTRACT

The single layer of CdSe,ZnSe and double layered of CdSe/ZnSe have been prepared onto titanium substrate by electro-co-deposition technique in an aqueous acidic of $CdSO_4$/ $ZnSO_4$ /SeO_2 and H_2SO_4(in acidic nature) employing 10mA/cm2 current density and deposition time duration 60/60(120)minute. These are used as photo electrode in photoelectrichemical cells and the photovoltaic characteristics are studied under illumination of 1950 Lux light intensity to evaluate various cell parameter such as short-circuit current(Isc), open-circuit voltage(Voc,),power output(Po), fill-factor(ff), and efficiency(η%). It has been found that single layer of ZnSe gives very poor performance and CdSe shows better result but a double layer of CdSe/ZnSe gives a better performance compare to the single layer film of CdSe, ZnSe .It is observed that all the solar cell parameter are improved by using double layer photo electrode as compared to any of the single layered photo electrode. The double layered photoelectrode converts larger portion of solar energy into electrical energy.

Keywords : Photoelectrochemical cells, CdSe/ZnSe double layer, Current density, Deposition time.

Fabrication of Electrochemical Cell and its discharge performance studies of newly synthesized Silver- Bismuth solid electrolytes

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ABSTRACT

A new silver ion conducting glassy electrolyte system was synthesized by melt quench method, which exhibited high ionic conductivity value ~ 10-3 s/cm. In the present paper we report the fabrication of electrochemical cell in following configuration :

Ag (Anode) /0.75[0.75AgI:0.25AgCl]: 0.25[Ag_2O: Bi_2O_3]/ C + I_2 Cathode

Th Open circuit voltage OCV of the cell was found to be 0.674 volts. Ionic transport number (t_{ion}) was calculated by electrochemical cell potential method which was found to be ~ 0.98. The discharge characterstic of the cell was performed under different load conditions and various cell paramenters viz Current density, Discharge capacity, Power density and Enegy density were reported.

Thermodynamic Properties of $La_{0.76}Sr_{0.24}CoO_3$ Perovskite Cobaltate

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ABSTRACT

We have investigated the thermophysical properties of perovskite cobaltate $La_{0.76}Sr_{0.24}CoO_3$. The specific heat has been studied as a function of temperature by means of Rigid Ion model (RIM). The temperature dependence of specific heat of $La_{0.76}Sr_{0.24}CoO_3$ as a function of temperature ($0 K \leq T \leq 275 K$) is reported. In addition, the results on the cohesive energy (f) and the effect of temperature on molecular force constant, Reststrahlen frequency (n) and Gruneisen parameter (g) are also presented.

Effect of doping on modulationally amplified polaron mode in compound semiconductor

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ABSTRACT

Controlling the frequency, intensity and direction of an optical beam by means of modulation creates viable transmission, display and processing of information. Coupling of LO phonons and free carrier collective excitations by macroscopic longitudinal electric field in polar semiconductors created a lot of interest in the study of polaron mode in semiconductors. In this paper, an analytical investigation has been made for modulational amplification of polaron mode in compound semiconductor. In the frame work of hydrodynamic model and coupled mode theory, under the assumption that the origin of modulational amplification lies in the third order optical susceptibility

Origin of the satellites due to L_3M_x - $M_xM_{4,5}$ transitions in the middle-Z elements

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ABSTRACT

In the present paper, the origin of the satellites $L\alpha_6$ and $L\alpha_7$ have been explained in the middle-Z elements on the basis of multiple ionization theory. The energies and the intensities of the various transitions corresponding to the L_3M_x - $M_xM_{4,5}$ (where x = 1-5) transition array, which may give rise to these satellites, have been calculated theoretically. The transition energies have been calculated using the available Hartree-Fock-Slater data for Auger transition energies. The intensities of the various transitions have been estimated by considering cross sections for Coster-Kronig transitions as well as for M-shell shake-off process occurring simultaneous to a L3 hole creation. The total cross sections for initial two-hole states amongst various allowed transitions from these initial states to the final states have been then distributed statistically. Theoretical satellite spectrum has been computed by assuming each transition as a Gaussian line. The overall spectrum has been computed as the sum of these Gaussian curves. The calculated energies have been found to be comparable with the measured energies of the satellites. Consequently, the transitions which give rise to the satellites have been identified.

Preparation and Characterization of pulsed laser deposited Fe_3O_4 and ZnO heterostructures

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ABSTRACT

Over the past few years there has been extensive study in the materials having spin based transport properties for their potential applications in the spintronic devices. Among these materials, oxide ferrimagnet Fe_3O_4 is a promising material for spin injection into a semiconductor due to its half metallic nature, high Curie point and low room temperature resistivity. Although Fe_3O_4 is the prototypical half metallic ferrimagnet, experimental demonstrations of its half metallicity have not been accomplished due, in part, to the failure to generate a good interface with both group IV and III-V semiconductors. There is hardly any report on growth of Fe_3O_4 on II/VI semiconductor.

In this work, we report the structural and magnetic properties of epitaxial bilayer configuration of Fe_3O_4/ZnO and ZnO/ Fe_3O_4 on single crystal alumina (0001) substrate. Both the bilayers were grown by pulsed

laser deposition technique. X-ray diffraction (XRD) study reveled (111) oriented growth of Fe_3O_4 and (0001) oriented growth of ZnO in both the bilayers. Phi-scan shows the epitaxial nature of individual layers in both the bilayers. In order to check the structural compatibility of these structures we annealed these samples at different temperatures. Raman spectra and XRD indicate the formation of $ZnFe_2O_4$ at the interface after annealing of ZnO/Fe_3O_4 bilayer. Magnetization measurements are in correlation with the structural results. The results indicate that Fe_3O_4 /ZnO bilayer is more stable and has sharper interface than the other bilayer.

Effect of Solar UV radiation on recent climate change and challenges in 21st century

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ABSTRACT

Solar UV radiation is a highly active component of solar spectrum. Solar UV radiation on the earth's surface increases with the depletion of stratospheric ozone. The excessive UV radiation has deleterious effects on all plant, animal, inhibition of photosynthesis and also a hazard to human health. The basic components that influence the Earth's climatic system can occur externally (from extraterrestrial systems) and internally (from ocean, atmosphere and land systems). The external change may involve a variation in the Sun's output. Internal variations in the Earth's climatic system may be caused by changes in the concentrations of atmospheric gases, mountain building, volcanic activity, and changes in surface or atmospheric albedo. There is an abrupt and drastic cooling in the climate can be possible in near future due to large scale melting of global ice by global warming, and prolonged sunspot minima. According to many studies by ISRO, GSI and other organizations indicate that the Nothern Himalayan Glaciers are receding by about 16 meter per year. The Gangotri glacier is retreating about 28 meters per year. The receding glaciers have major implications for water availability in the glacier fed rivers such as the Ganga and the Yamuna. Glaciers in the Garhwal region of the Himalayas are retreating so fast that researchers believe they will disappear by 2035. Arctic ice has thinned significantly over the past half century. Between 1979 and 2007, it has shrunk by 44%, and it is predicted that a complete meltdown is possible by 2030 or sooner [1]. Adverse impacts of global warming and resulting climate change will be superimposed on these changes and will exacerbate water shortages in many water-scarce areas of the country. During different times in the past, different rivers changed their course a number of times.

There is a close correlation between variations in the 11-year sunspot cycle and Earth's climate. Solar activity varies on shorter-time scales, including the 11-year sunspot cycle and longer-term as Milankovitch cycle. The potential role of solar luminosity in modulating recent climate has been debated for many decades. Before the

satellite period solar luminosity had been scaled from proxy data that exists large uncertainty. Recently, variations measured from spacecraft since 1978 are too small to have contributed appreciably to accelerate global warming over the past 32 years. The long-term solar irradiance variations might contribute to global warming over decades or hundreds of years. Sun has shown a slight cooling trend since 1960, over the same period that global temperatures have been warm. According to TSI variation trends in recent decades, the Sun has contributed a slight cooling influence but our globe is warmed up continuously. It is indication for a dangerous period and high awareness about global warming is most essential. Adverse impact of climate change and global warming in our ecosystems and challenges in the 21st century along-with perspective role of solar source activities in recent climate change have been discussed.

Electroluminescence of ZnSe:mN in PVA Matrix

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ABSTRACT

Polymer-inorganic nanocomposites have attracted much attention recently due to their unique size dependent chemical and physical properties. Mn doped ZnSe nanoparticles in polyvinyl alcohol (PVA) matrix were prepared by single step solution method. All the ZnSe:Mn/PVA film samples were prepared by changing PVA loading.

It was found by absorption spectra that the absorption edge was shifted towards lower wavelengths with increasing loading of PVA in ZnSe:Mn/PVA nanocomposite. PVA acts as a capping agent so when there was increase in PVA loading the particles were capped and hence smaller ZnSe:Mn nanoparticles were obtained.

For Electroluminescence (EL) study of ZnSe:Mn/PVA films were deposited onto the conducting glass plates and EL cells were prepared by using aluminum foil as an electrode and conducting glass plate itself acted as second electrode. The EL brightness of the cell with different PVA loading was recorded at various frequencies. EL started at threshold voltage and then EL brightness increased with the applied voltage. At any particular voltage higher brightness was obtained for smaller particle size and higher frequency. It was observed that there was linear relation between current and voltage for all samples. It was found that samples having smaller particle size shows better EL and impedance was also lower for them.

Preparation, Characterization and Electroluminescence Studies of Copper Doped Zinc Sulphide Nanocrystals

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ABSTRACT

The optical and electrical properties of nanomaterials can be controlled by their particle size and therefore attracted much interest for their fundamental and applied aspects.

Copper doped zinc sulphide nanoparticles were prepared by chemical precipitation method. The size of the particles was varied by changing the concentration of capping agent.

The XRD studies indicate that most of the samples are cubic in nature. The broadening of peaks tends to increase with increasing capping agent concentration showing decrease in particle size. The crystalline size computed using scherrer formula is found to be in range of 3 to 10 nm.

Absorption spectra show absorption edge in UV region. The edge was found to shift towards shorter wavelength as the capping agent concentration is increased. This indicates increased effective band gap and hence reduced particle size. The nanoparticle size has been estimated in the range 5 to 10 nm using effective mass approximation model.

For electroluminescence (EL) study of ZnS:Cu nanocrystals, the EL cells were prepared by placing ZnS:Cu nanoparticles between SnO_2 coated conducting glass plate and aluminium foil. Alternating voltage of various frequencies was applied and EL brightness (B) at different voltages (V) was measured with the help of photomultiplier tube and corresponding current was also recorded. It is found that, emission starts at a threshold voltage and then increases rapidly with increasing voltage. The lower threshold and higher brightness have been observed for smaller particles. On increasing the voltage, current increases linearly indicating ohmic nature.

Size Dependence of the Band Gap of SiNWs Along [1 1 1] Direction

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ABSTRACT

In this work electronics properties of hydrogen-passivated, free-standing silicon nanowires, oriented along [111] direction with triangular cross section are studied for different area of cross section by DFT using GGA approximation.

Keywords : GGA, nanowire

High Pressure Structural Phase Transition and Elastic Properties of HoBi

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ABSTRACT

We apply a theoretical method, inter-ionic potential theory with modified ionic charge to investigate the structural and elastic properties of HoBi at ambient and high pressure. The HoBi belongs to the wide class of binary rare-earth compounds and crystallize in B_1 structure (Ho: 0, 0, 0; Bi: 1/2, 1/2, 1/2; space group $Fm^{3}m$ (225)). The presence of 4f electron is mainly responsible for the various magnetic and electrical properties in these compounds. We predict a structural phase transition for HoBi, from NaCl (B_1) - to CsCl (B_2)-type structure at 26 GPa with 6% relative volume change and other properties, such as lattice constant, bulk modulus, cohesive energy and second-order elastic constants are calculated and compared with the available experimental and theoretical data.

Keywords: Structural phase transition, elastic properties, lattice constant

Thermoluminescence of Γ-Irradiated Impurity Doped Li2b4o7 Glasses and Powder Phosphers

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ABSTRACT

The present paper reports the thermo luminescence (TL) of γ-irradiated Mn Ag and Cu doped Li_2BPO_7 glasses and powder phosphors. The TL glow curve of γ-irradiated impurity doped $Li_2B_4O_7$ glasses or phosphor possesses two peaks .In Mn, Ag. And Cu doped $Li_2B_4O_7$ glasses, the first peak lies at 58.94 and 124^{0}C respectively and the second TL peak lies at 204,143 and 209 ^{0}C respectively. The peaks of TL intensity of γ-irradiated glasses or phosphors , initially increase with increasing γ-dose, and then tthey tend to attain saturation values for higher γ-doses. The TL emission is optimum for an activator concentration of 0.1wt%. the mechanism of TL in these glasses and phosphors has been discussed.

Key words : Thermo luminescence , glasses defects, dosimetry

Critical Temperature for Superconductivity and its Applications

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ABSTRACT

Electrical resistance in metals arises because electrons moving through the metal are scattered due to deviations from translational symmetry. These are produced either by impurities, giving raise to a temperature independent contribution to the resistance, or by the vibrations of the lattice in the metal. In a superconductor below its critical temperature, there is no resistance because these scattering mechanisms are unable to impede the motion of the current carriers. If mercury is cooled below 4.1 K, it loses all electric resistance. This discovery of superconductivity by H. Kammerlingh Onnes in 1911 was followed by the observation of other metals which exhibit zero resistivity below a certain critical temperature. The thirty pure metals listed at right below are called Type I superconductors. Superconductors made from alloys are called Type II superconductors. Besides being mechanically harder than Type I superconductors, they exhibit much higher critical magnetic fields. Type II superconductors such as niobium-titanium (NbTi) are used in the construction of high field superconducting magnets. Superconducting magnets are some of the most powerful electromagnets known. They are used in MRI and NMR machines, mass spectrometers, and the beam-steering magnets used in particle accelerators.

Specific Rotation of Neera Borassus Flabellifier 'BF', Sucrose and Glucose in aqueous solution at 303K.

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ABSTRACT

The intensely sweet juice, called Neera, was collected overnight and fermented naturally during the heat of the day. Neera is natural liquid, mainly contained sucrose. Due to this type of nature Neera is useful for different purpose like in bio-medical, chemical industries etc. Each liquid has a different angle of specific rotation and ultrasonic velocity; it's depending on the content and concentration of the liquid. This is used as a healthy drink in connection with Aurvade and other systems of medicine. Neera is collected over night from the west part of M.P. dist. Dhar India. All the substances which show optical activity in liquid state or in aqueous solutions have in their molecules some asymmetry. For these purposes in the present study we measured specific rotation of Neera BF liquid, Sucrose and Glucose in aqueous solution at room temperature 303K.We were used Laurent's half shade Polarimeter for optical activity. The aqueous solutions of Neera BF liquid, Sucrose and Glucose were made by using

double distilled water.

Key Words: specific rotation, aqueous, optical activity, polarimeter.

First-Principle Calculations for Elastic Properties of Transition Metal Diboride TMB_2 *(TM= Os, Nb, Ti, Zr and Ru) Compounds*

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ABSTRACT

Elastic properties of a solid are closely correlated with various fundamental physical properties, such as specific heat, melting point, interatomic bonding, equation of states, Debye temperature, thermal expansion coefficient, and so on. Moreover, what is more important, the knowledge of elastic constants of a solid provides access to understand the mechanical properties for practical application in many fields, e.g. sound velocity, anisotropy, thermoelastic stress, load deflection, fracture toughness, etc. Furthermore, one can also directly obtain some useful information on the characteristics of bonding and the structural stability of a crystal.

In the present paper the elastic properties of various TMB_2 (TM= Os, Nb, Ti, Zr and Ru) compounds have been investigated under pressure through the quasi harmonic Debye model.

Lattice Dynamics Study of Transition Metal Diboride TMB_2 (TM= Os, Nb, Ti, Zr and Ru) Compounds

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ABSTRACT

Today, the transition metal diborides are of great interest because they have been found to possess unique physical and chemical properties such as high hardness, high melting point and oxidation, and have wide range of industrial applications. The diborides are members of a broad class of materials known as the boron-rich solids, which consist of extended networks of covalently bonded boron (B) atoms stabilized through donation of electrons from the metal atoms. The hexagonal AlB2 structure, into which these transition-metal diborides crystallize, is build up of hexagonal nets of pure transition-metal atoms and triangle nets of pure boron atoms.

The physical properties of these compounds have received less or none attention. To our knowledge, lattice dynamical and thermodynamical properties, which are the important bulk properties for solids, have not been considered theoretically for these compounds so far. In the present paper, the lattice dynamical as well as thermodynamical properties of TMB_2 (TM= Os, Nb, Ti, Zr and Ru) compounds have been investigated under pressure through the quasi harmonic Debye model.

Effect of Cr doping in Structural, Transport and Magneto-transport Properties of $LaMnO_3$

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ABSTRACT

The study of perovskite manganites $La_{0.67}Sr_{0.33}Mn_{1-x}Cr_xO_3$ ($0 \leq x \geq 10$) has been carried out. The structural, transport and magneto-transport properties of $La_{0.67}Sr_{0.33}Mn_{1-x}Cr_xO_3$ manganites are strongly dependent on the doping level x. Polycrystalline samples of $La_{0.67}Sr_{0.33}Mn_{1-x}Cr_xO_3$ ($0 \leq x \geq 10$) were prepared by solid state reaction method. The little difference between the ionic radii of Cr^{3+} and Mn^{3+} causes no change in the structure, the structure remains rhombohedral. The temperature dependence of the resistivity is measured from 5 K–400 K without and with magnetic field upto 5 T. A considerable change occurs in transport and magneto-transport properties with respect to the sample without Cr. The value of metal-insulator (M-I) transition temperature (TP) decreases for all the samples while doping level x increases. The Cr-doped manganites exhibit a large variation in resistivity values. The resistivity increases for the 5% doping of Cr, while more Cr doping level increases resistivity decreases. The value of magnetoresistance (MR) increases with increases Cr doping level for all samples. The transport and magneto-transport behavior pretentious by Cr doping.

Keywords : Colossal magnetoresistance, metal-insulator transition, Mn site doping.

STUDY OF HEAT CAPACITY OF $LaCoO_3$

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ABSTRACT

The heat capacity of $LaCoO_3$ compound, was determined .This compound attracted much attention due to its unusual electronics and magnetic properties at ambient pressure. Modified Rigid ion Model (MRIM) was selected for studying the cohesive and thermal properties of this compound. As these materials are of technical importance, a lot of experimental work has been done and some efforts have been made to study the theoretical properties. It may be concluded that the MRIM is suited to calculate the thermal properties of $LaCoO_3$. We have also calculated the cohesive energy, molecular force constant, Restrahalen frequency,Deby's temperature, specific heat Gruinisen parameters at the temperature range 0K<T<300K.Specific heat versus temperature of this compound was plotted ranging from 0K<T<300K. Using MRIM it was found that specific heat curve follows the same trend of

variation as that of available experimental data upto the temperature range of 300K. Thus a successful description of specific heat is achieved for $LaCoO_3$. Thus system is remarkable in view of the inherent simplicity and less parametric nature of MRIM Model.

Key words : $LaCoO_3$ compound ,cohesive energy, Molecular force constant , Restrahalen frequency, Deby's temperature , specific heat.

Nil Contribution of Bulk Viscous to Bianchi type-VI_0 Cosmological Model

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ABSTRACT

A homogeneous and isotropic Bianchi type-VI_0 cosmological model does not accommodate bulk viscous in biometric relativity. Further, it is observed that resulting space-time is free from singularity.

Key World : Bianchi type-VI_0, Bulk viscous, Bimetric Relativity

Mechanoluminescence Induced by Application of Loads on Phosphorescent Crystals

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ABSTRACT

Luminescence is the cold light from certain sources of energy, which takes place at normal and lower temperatures. Mechanoluminescence (ML) is an interesting phenomenon whereby mechanical energies such as compression, friction and fracture are converted directly to light. In the present paper, the mechanoluminescence is induced in triphenylphosphine oxide manganese bromide phosphorescent crystal by loading technique. The ML intensity is sensed by the photomultiplier tube whose output was recorded using storage oscilloscope. When a load is applied on a crystal, then the ML emission takes place in the form of light pulses. The number of ML pulses and the time duration tc for the appearance of ML increase with increasing value of load and the average ML intensity from a single ML pulse decreases with increasing value of the load. For a given value of the applied pressure, the total number NT of ML pulses, the total ML intensity IT and the time duration tc of ML emission increases with increase in size of the crystal. As the total ML intensity is directly related to the area of the newly created surfaces, the

pressure dependence of the total ML intensity shows that initially the total area of newly created surfaces increases with increasing value of the applied load and after that it attains a saturation value for higher values of applied load. As the strain rate is maximum at a particular time after the application of the load on a crystal the rate of the emission of ML pulses is maximum at a particular time after the application of load on the crystals. The dependence of NT, IT, and tC on the applied pressure Po follows the following expressions respectively

Structural and Electrical properties of Sr_2CoO_4 thin films

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ABSTRACT

Sr_2CoO_4 is an A_2BO_4 layered type perovskite oxide, which exhibits K_2NiF_4-type structure. Sr_2CoO_4 has been reported as a metallic ferromagnet with high curie temperature Tc (~255K), therefore, there is a possibility of exploring this material for spintronic application. However, synthesis of Sr_2CoO_4 both in bulk and thin film form is difficult.

Here using the non-equilibrium process of pulsed laser deposition (PLD), we succeeded to synthesize oriented films of Sr_2CoO_4 (SCO) on single crystalline (001) $LaAlO_3$(LAO) and (001) MgO substrates. A comparative study of structural and electrical properties of Sr_2CoO_4 thin films is carried out by using X-ray diffraction, X-ray photoemission spectroscopy and four probe resistivity measurements. The two films showed identical crystalline growth inspite of the huge lattice mismatch in lattice parameters of SCO and MgO as compared to SCO and LAO. The four probe resistivity measurement revealed semiconducting nature of these films. However, the resistivity behavior on different substrates brings out different transport mechanism suggesting that though crystalline structure wise both the films are similar, microscopically the defect structure in the two films could be different. We also determined valence state of Co in Sr_2CoO_4.

Keywords : Spintronic, Pulsed laser deposition**,** X-ray photoemission spectroscopy.

Study of specific heat of diluted $PrMnO_3$ manganites.

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ABSTRACT

We have applied modified rigid ion model (MRIM) to find out specific heat of diluted $PrMnO_3$ manganites at temperature range from 0-200 K .We have doped Ca and Ca ,Cr in the parent compound $PrMnO_3$ .The model parameters and thermal properties i.e.the cohesive energy (Φ), molecular force constant (f), compressibility (β), restrahalen frequency (ν_0),Debye temperature (θ_D), and gruineisen parameter (γ) of $PrMnO_3$, $Pr_{0.5}Ca_{0.5}MnO_3$ and $Pr_{0.5}Ca_{0.5}Mn_{0.97}Cr_{0.03}$ are calculated which are in good agreement with corresponding experimental data . In the experimental curve of $PrMnO_3$ there is a magnetic transition at 96K in parent compound which is due to the A-AF ordering , but for the doped manganites there is no magnetic transition .There is a decrease in specific heat for the doped manganites

First Principles Study of Electronic, Elastic and Thermal Properties of YX (X = Au, Hg and Tl) Intermetallics

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ABSTRACT

The electronic, elastic and thermal properties of YX (X = Au, Hg and Tl) intermetallic compounds crystallizing in B_2-type structure have been studied using first principles density functional theory within generalized gradient approximation (GGA) for the exchange correlation potential. All YX compounds are stable in B_2 structure at ambient condition. The ductility of these compounds has been analyzed using the Pugh rule. Our calculated results indicate that YTl is the most ductile amongst all the B_2-YX compounds. YAu is the hardest and less compressible compound due to the largest bulk modulus. The elastic properties such as Young's modulus (E), Poisson's ratio (σ) and anisotropic ratio (A) are also predicted. The hybridizations Y – d, X – d and X – p states characterized by charge density plot along [111] and [110] directions.

Spectral Decomposition of VLF signal observed by DEMETER satellite by Continuous Wavelet Packet Transform (CWPT)

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ABSTRACT

Spectral Decomposition as a special attribute, gives us a unique tool for the analysis of Geophysical signals. In past Short Time Fourier Transform (STFT) was used for the analysis of Time-varying, non stationary signal such as VLF and Seismic signal, but it has many limitations, So Morlet (1982) used continuous wavelet transform (CWT) for these purpose. Experiments prove that it should be a better choice as compared to STFT for the analysis of these signals. In these work for the advanced study of VLF signals, we introduced a new technique called Continuous Wavelet Packet Transform (CWPT) as the extension of CWT. CWPT is a very flexible technique as compared to STFT and CWT. It provides high resolution and greater efficiency. Our analysis shows that these methods is very suitable for the analysis of VLF signal because its shows all frequency contents of signal very clearly, which helps us to identified and study the different phenomena related to VLF signals.

Structural Phase Transition and Elastic Properties of Samarium Monopnictides

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ABSTRACT

Pressure induced structural phase transition of three samarium mono pnictides (SmX : X=P, Sb and Bi) has been studied theoretically using an inter ionic potential with modified ionic charge which parametrically includes the effect of Coulomb screening by the delocalized *f*- electrons of rare earth ion. The anomalous structural properties of these compounds have been interpreted in terms of the hybridization of *f*- electrons with the conduction band and strong mixing of *f*- states of Sm ion with the p orbital of neighbouring pnictogen ion. All the three compounds are found to undergo from their initial NaCl (B_1) phase to body centered tetragonal (BCT) phase at high pressure and the calculated results agree well with the experimental results. The nature of bonds between the ions is predicted by simulating the ion-ion (Sm-Sm and Sm-X) distances at high pressure. Second order elastic constants have also been calculated at ambient pressure.

High Pressure Structural Phase transition, Mechanica and Thermal Properties of UBi Compound.

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ABSTRACT

We have investigated the effect of high pressure on UBi compound by using a modified inter-ionic potential theory (MIPT), employing the minimization technique of Gibbs free energy expressed as a function of pressure. We have also presented the equation of state, which shows an appreciable volume collapse at the phase transition pressure and associated volume collapse are generally in good agreement with their experimental and theoretical findings. We have also determined the equilibrium lattice constant, bulk modulus second order elastic constant, young's modulus, shear modulus, poisson's ratio and thermal properties for UBi compound. These properties show a significant improvement over other theoretical and experimental results.

Keywords: Phase transition, Thermal properties, Elastic constant.

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Computer Technlque In Drug Designing

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ABSTRACT

Chemo informatics-science of managing analyzing combines elements of biology and science analysis in chemo informatics focus on overall type of large data set available 3-D chemical database and compound libraries computation techniques are interdisciplinary approaches draw from specific discipline such as mathematics physics, chemistry computer science, engineering and life science. Computational chemistry is a discipline using mathematical methods for the calculation of molecular properties or for the simulation of molecular behavior. it improves eg. Synthesis, planning, database searching and combinatorial library manipulation computational chemistry have many computer added techniques like:-

1. computer- added molecular design (CAl\/ID)
2. computer added drug design CADD
3. computer added molecular model

CADD is a recent and emerging discipline that uses several bioinformatics tools and aited field like chemo informatics and combinatorial chemistry. it involves all computer added techniques used to discover, design and optimize biological active compounds with a putative use as drugs.

Drug designing is an iterative one, involving drug discovery, Ieate optimization and chemical synthesis , drug discovery process goes through several stages. Drugs can works in one of the following ways — interfere with biological function of virus etc, block instruction of virus with our system over own biological function . for example lock and key hypothesis explain the enzyme mechanism the most important aspect in drug design is the understanding methods by which the active site of a receptor selectively restricts the binding of inappropriate structures any potential molecule that can bind to a receptor — legend .for legend to bind receptor, must posses the molecular key that binds the receptor lock . legend binding is the base on the complimentary relationship between the ligand and binding site there are three basic approaches for designing drugs- target- based approaches ,structure —-t based approaches , De Novo- approaches legend based approaches are used when the receptor is not known ligand beset}; approaches try to identify characteristics common to known legend to used in screening for new or improved drugs by two method QSAR and pharmacophore. AQSAR study try to establish link between the ability to of a certain molecule to perform its function and properties of the molecule. a pharmacophore is the specific 3-D arrangement of functional groups within a molecular frame work that are necessary to bind a macro molecule and , or an enzyme active site . the identification of a pharmacophore is an a important step in understanding the interaction between a receptor and a ligand docking method is most popular approach for target- based method docking involves scanning a data based of known molecule for those likely to bind well to the receptor De Novo design is the approach to built a customized ligand for a given receptor this approach involves the ligand optimization. the most challenging aspect of drug design an development is the rule of three relating to activity , exposer , toxicity

ADME — Tox properties are widely used in drug discovery convert lead compound into drugs save for human patent an it is proposed that integration off experimental and in silico (computational) tools should be applied for ADIVIE — Tox prediction the computational approaches encompasses in silico method to identify potentially toxic groups , for which several programmes are available

Invited Talk

Computational Chemistry

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ABSTRACT

Computational chemistry simulates chemical structures and reactions numerically, based in full or in part on the fundamental laws of physics." Computers Complement and Alternative to Lab Experiments. They investigate unusual temperature/pressure regions, simulate dangerous experiments, find alternative for hazardous chemicals,gain an atomistic description of a reaction & save lab costs. These help in Understanding of Reaction Mechanism, characterize reactive intermediates, identify rate determining or stereoselective steps, controlling and tuning of chemical reactions , Which results in optimization of catalysts & rational drug design.

- Computer experiments need models and theories pertaining to different fields e.g. environmental sciences,biology,chemistry,physics etc. to describe the laws of nature with the language of mathematics .

Conducting a Computational Project
These questions should be answered

- What do you want to know?
- How accurate does the prediction need to be?
- How much time can be devoted to the problem?
- What approximations are being made?

The answers to these questions will determine the type of calculation, model and basis set to be used.
Computational Models

- A model is a system of equations, or computations used to determine the energetics of a molecule
- Different models use different approximations (or levels of theory) to produce results of varying levels of accuracy.
- There is a trade off between accuracy and computational time.
- There are two main types of models; those that use Schrödinger's equation (or simplifications of it) and those that do not.

Types of Models
(Listed in order from most to least accurate)

- Ab initio : uses Schrödinger's equation, but with approximations
- Semi Empirical: uses experimental parameters and extensive simplifications of Schrödinger's equation
- Molecular Mechanics: does not use Schrödinger's equation

The Schrödinger equation

- The Schrödinger equation is the basis of quantum mechanics and gives a complete description of the electronic structure of a molecule. If the equation could be fully solved all information pertaining to a molecule could be determined.
  - Complex mathematical equation that completely describes the chemistry of a molecular system.

- Not solvable for systems with many atoms.
- Due to the difficulty of the equation computers are used in conjunction with simplifications and parameterizations to solve the equation.

- Describes both the wave and particle behavior of electrons.
  - The wavefunction is described by ψ while the particle behavior is represented by E.
  - In systems with more than one electron, the wave function is dependent on the position of the atoms; this makes it important to have an accurate geometric description of a system.
- The underlying physical laws necessary for the mathematical theory of a large part of physics and the whole of chemistry are thus completely known, and the difficulty is only that the exact application of these laws leads to equations much too complicated to be solvable."

OP - 1

Synthesis and Computational Study of 2-amino-5-(3-iodo-4-N,N-bis-2-carboxy ethyl amino phenyl) 1,3,4-thiadiazole

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ABSTRACT

Thiadiazoles and their derivatives are well known as compounds of a wide range of pharmacological activities like anti inflammatory, antidiabetic, anticancer, anticonvulsant, anti dipressant, radioprotective and anti oxidant. This paper covers the synthesis of the title compound by the cyclization of thiosemicarbazone of 3-iodo-4-N,N bis -2- carboxy ethyl amino benzaldehyde. The synthesized compound was in good agreement with elemental and spectral data. The optical constants and complex dielectric constants of the compound were calculated theoretically by use of DFT(B3LYP) method and dipole moment, electronegativity, HOMO and LUMO energies obtained from DFT calculations were in agreement with the experimental data which gave valuable information in the assessment of the antibacterial and antifungal activities of the compound.

Key words: 1,3,4-Thiadiazole, anti inflammatory, anti cancer, synthesis

OP - 2

A Novel Approach using MATLAB for Arsenic Removal

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ABSTRACT

A new reagent system is utilized to develop chemo sensors for removal of arsenic. The disposable sensors were prepared by immobilizing sulfanilic acid and NEDA (N-{1-naphthyl} ethylene di amine di hydrochloride) on TLC strips. The adsorption of arsenic on sensor results into a colored spot (purple to magenta). The sensors were then scanned and the images were analyzed using MATLAB software. The differences in RGB pattern before and after adsorption enable to know the percent removal (nearly 95%).Proposed sensor was investigated for its ability to remove from 100-1000µg mL-1.

Keywords: MATLAB, TLC, chemo sensor, removal.

OP - 3

Interaction of Copper (II) with Benzimidazole Moeity

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ABSTRACT

Metal complex of Cu(II) has been synthesized with Rabeprazole (RAB) drug that is 2-([4-(3-methoxy propoxy)-3-methyl pyridin-2-yl] methyl sulfinyl)-1H- benzimidazole, a proton pump inhibitor (PPI). PPIs have demonstrated gastric acid suppression superior to that of histamine H2 receptor blockers. The literature reveals that a large number of drugs have been used to synthesize the complex with many metals with a view to enhance their therapeutic action. RAB is a weak base and it can form several complexes with transition and non-transitions metal ions. Formation of new complex has been supported by elemental analysis, conductivity measurements and spectral studies including IR ,1H NMR , UV, magnetic susceptibility , ESR , TGA , XRD , SEM and mass spectral studies. The molar conductance measurements of the complex in DMSO indicate that the complex is 1:2 electrolytic in nature. Analytical data and stochiometry suggest ligand metal ratio of 2:1 for the complex. The spectroscopic results show the involvement of C=N and S=O groups in coordination to the central metal ion. Based on spectral studies, tetragonally distorted octahedral geometry has been proposed for the complex. The ligand and its complex were tested for their antibacterial and antifungal activities against bacteria Pseudomonas, Staphylococcus aureus and fungi A. niger and A. flavous. It is observed that the complex is a better bactericidal agent than the parent drug.

Key Words: Complex, Benzimidazole, Ligand, PPI, XRD, SEM.

Analysis of Milk and its Constitution by Physico Chemical Methods

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ABSTRACT

Milk is defined as the secretion of the mammary glands of mammals, its primary natural function being nutrition of the young. Milk of some animals especially cows, buffaloes and goats, sheep is also used for human consumption, either as such or in the form of a range of dairy products.

Global System for Mobile Communication

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ABSTRACT

The Global System for mobile communication is by far the most successful mobile communication system worldwide. There are three versions of GSM, each using different carrier frequencies. The original GSM system uses carrier frequencies around 900 MHz, carrier distance 0.2 MHz, effective frequency 50Khz per channel, cross be rate on the air interface 271 Kbytes, symbol duration 37 μs, maximal 12F transmission power at the ms 2W,power control 30db dynamics.

Keywords : Frequencies, carrier

Extraction and Determination of Hemicellulose from Lantana Wood

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ABSTRACT

In our country paper industry is primarily dependent upon forest-based raw materials as wood pulp. The plant under consideration is fast growing, easy in debarking and chipping and found abundantly in M.P.hence its

eradication is also needed otherwise it will cover maximum part of valuable land, forest and growing areas. By the help of the method Wise &coworkers holo cellulose was extracted quantitatively. The dried sample was debarked and converted into chips and made to dust in 40 mesh and 60 mesh pass, retained and analyzed for ash content, cold water solubility, hot water solubility, alcohol benzene solubility, ether solubility, alkali solubility, lignin content, pentosan content, alpha cellulose, beta cellulose, gamma cellulose, holo cellulose, hemi cellulose, acetyl value, methyl content, uronic anhydride etc. Standard methods like Tappi procedure, Canadian standard method are used to chemically analysed the wood & results are recorded and comparative study of Lantana Wood dust is done with eucalyptus hybrid and Ipomea carnea. The results are 34.3% O.D. basis hemi cellulose was recorded in Lantana wood, which was more than eucalyptus hybrid and Ipomea carnea. So it can be profitably used in the manufacture of paper.

Keywords : Debarking, Holo cellulose, Hemi cellulose, Tappi procedure.

Investigation of Reduction of Chromic Acid by Phenylacetic Acid and Evaluation of Various Kinetic and Thermodynamic Parameters

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ABSTRACT

In present work, kinetic investigation pertaining to reduction of chromic acid by phenylacetic acid in presence of chloro sustituted aceticacids has been carried out . Amongst various oxidants chromic acid is one of the most versatile oxidant and received ample attention during past few years. The effect of four acids of different types (viz,acetic acid{weak},mono-chloroacetic acid {moderately strong},dichloroacetic acid and trichloroacetic acids {strong})on the rate of reaction have also been investigated . In present case all the four acids accelerated the reaction rate in the pH range of 0.51-1.72 and catalytic constants calculated from hydrogen ion concentration were found 3.62x10^ -2 , 13.97x10^ -2 , 4.27x10^ -2 and 4.582x10^ -2 respectively. The salt effect observed in the reaction may indicate the actual nature of the reacting species. Retarding effect of Na and K salts were observed . It seems to be linear as well as exponential function of salt. The effect of salts have been investigated at 3 different temperatures and temperature coefficients have been calculated from kinetic data and the observed effect of salts have been explained on the basis of Transition State Theory . The retarding effect of K > Na was observed. The dielectirc studies are significant in kinetic investigations. Dielectirc constants have been evaluated from measaured values of refractive index of various systems. At constant temperature a drop of mixture was taken out and put in an Abbe's refractometer at known wavelength and dielectric constants calculated from these values. The dielectric constant lies in between 1.7743 - 1.8105. As far as the thermodynamic parameters are concerned , the average values calculated of E# , A and S# from standard equations using first order rate constants obtained at different temperatures were found 12.148 kcal , 3,428x10^6/min and -52.428 EU respectively. All these experimental data, findings and literature survey have been used to suggest the reaction mechanism. It is clear from results that the present work is an addition to existing information available regarding reduction of chromic acid.

Computational Study of Coordination Compounds to Synthesize New Drugs

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ABSTRACT

Study of coordinate compounds has been of great importance, especially in the light of the observation that certain Metal complexes of the drugs are more potent than the parent drug. With this view in this study some metal complexes of certain antibiotics have been synthesized for their activity towards gram positive and gram-negative bacteria viz. Klebsiella, Staphylococcai, Pyocynus and E. coli. Antibiotics used were Ampicillin, Amoxycillin, Chloramphenicol, Streptomycin and Oxytetracycline. Structure of metal complexes were studied via Ab Initio method.computational as well as spectral observations indicate formation of a chelate involving its carboxylate ion and the nitrogen atom of thiazolidine ring.The amide band in the drug at 1768cm^{-1} shifts to ~1740cm^{-1} in the complexes while, asymmetrical and symmetrical oco- frequencies shift from ~1607cm^{-1} to ~1620(bb)cm^{-1} and from 1393cm^{-1} to ~1380cm^{-1} respectively. Vibrations of the computed spectrum were matched with those of the experimental spectrum. It was observed that some metal complexes are more effective than parent drugs which are as follows: Mn (II) and Zn (II) Complexes of Ampicillin, Cd (II) Complex of Amoxycillin, Mg (II) and Ni (II) Complexes of Chloramphenicol, Mg (II), Cu (II), Ni (II), Mn (II) and Zn (II) Complexes of Streptomycin, Zn (II), Cd (II) Complexes of Oxytetracyclin.

Micromeritics Viscosity Studies of Mixed Ligand Complexes of Cu (II) Mn (II), Zn (II), Co (II) with Ranitidine an anti drug and cytosine

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ABSTRACT

The synthesis and characterization of mixed ligand complexes of ranitidine and an anti ulcer and cystiene have been reported by us. The study of particle size is very important in drug industry and the technology is termed as micromeritics. Particles size of the various complexes along with the anti ulcer drug ranitidine were determined by the microscopic method. The information regarding the transportation and drug solvent interaction can be achieved by viscosity measurement. The Jones- Dole equation has been used to analyse the relative viscosities of Drug complex solution and water. Falkenhagen coefficient was determined to find out existence of ion-ion interaction. Jones-dole coefficient was studied to findout ion-solvent interaction. Partical size determination and viscosity measurement have been done of mixed ligand complexes of Cu (II), Mn (II), Zn (II), Co (II), Fe (II) with ranitidine an anti ulcer drugs and cysteine, an amino acid. The study show that the movement of the fairly large drug molecules, which indicates that diffusion of Ranitidine in passive transport system may be lower in comparison to its complexes

Friedel-Crafts Acylation Process in Ionic Liquids

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ABSTRACT

Ionic liquids are Non-flammable, Negligible vapor pressure (High boiling point) High thermal, chemical, electrochemical stability and having high solvating ability.They having tunable miscibility with water and Organic solvents, High electrical conductivity and Low viscosity in the liquid state. In present study we have synthesized acetates by Friedel crafts acylation. Mechanistic study of synthesis of different acetates in different Ionic Liquids has been reported here. In the presents study we have used triethylammonium sulphate [TEA][HSO_4], triethylammonium hydrogen chloride [TEA][HCl], choline bromide [ChBr], tetrabutylammonium bromide [TBAB], 1–butyl-3-methylimidazolium hexafluorophosphate [bmim][PF_6]. In the conventional method the yield is low and required more time. Optimization of reaction condition in synthesis of acetates investigated that 1–butyl-3-methylimidazolium hexafluorophosphate was the appropriate solvent with maximum yield and time factor.

Keywords: Friedel-Crafts acylation, solvent-free.