

# Science & Engineering of Lanthanides Doped Materials for 21<sup>st</sup> Century Applications

## Overview

Lanthanides, also known as rare earth elements (REMs), have recently found applications in a wide range of fields like photonics, spintronics, advanced optics, photovoltaics, automotives, and medical technologies. The uniqueness of bonding and intra-4f electron shell transitions in lanthanide based materials make it possible to engineer them suitably to get novel materials for diverse applications. Some of the *target applications* are automotive accessories, energy and power generation devices, solid-state lighting and displays, portable electronics, smart phones and telecommunication, and in vivo biological probes.

The objective of this course is to present the fundamental concepts of REMs spectroscopy through the exploration of their physical and chemical properties. The students will be guided in a step by step manner. Through this course the student will gain functional knowledge regarding chemical reactivity of REMs, synthetic details, specific physical properties, 4f electron configurations and energy levels thereof, intensities of intra-4f shell transitions, and signatures of physico-chemical interactions between rare-earth ions. Numerous physical models supported by a plethora of experimental evidences will be discussed. Science and engineering will be directly linked through discussion of practical and real-world problems.

<b>Dates for the Course</b>	<b>6<sup>st</sup> Dec, 2016 to 22<sup>th</sup> Dec, 2016</b>
<b>Host Institute</b>	<b>IIT Madras</b>
<b>No. of Credits</b>	<b>2</b>
<b>Maximum No. of Participants</b>	<b>100</b>
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>▪ You are materials scientist, chemist, physicist or engineer interested in the applied science and engineering of functional materials, technical ceramics, and/or related areas.</li><li>▪ You are an industrial engineer keen on doing cutting-edge research and development in any of the <i>target applications/areas</i> identified above.</li><li>▪ You are a student or faculty from academic institution interested in industrial directions, and current applied research and development in this important area of materials science.</li></ul>
<b>Course Registration Fees</b>	<p>The participation fees for taking the course is as follows:</p> <p><b>Student Participants:</b> Rs.2000 <b>Faculty Participants:</b> Rs.6000 <b>Government Research Organization Participants:</b> Rs.10000 <b>Industry Participants:</b> Rs.20000</p> <p>The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges.</p> <p><b>Mode of payment: Demand draft in favor of “Registrar, IIT Madras” payable at Chennai</b></p>
<b>Accommodation</b>	<p>The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: <a href="http://hosteldine.iitm.ac.in/iitmhostel">http://hosteldine.iitm.ac.in/iitmhostel</a></p>

## Course Faculty



**Wojciech M. Jadwisienczak** was born in Torun, Poland, in 1969. He received the M.S. degree in microelectronics from Nicolas Copernicus University, Poland in 1995 and the Ph.D. degree in electrical engineering from Ohio University, U.S.A. in 2001. Since 2001 he is affiliated at different professorship ranks with the School of EECS in

Russ College of Engineering at Ohio University. His primary research focuses on fundamentals of semiconductors for optoelectronics, photonics and spintronics. Specifically, he is involved with spectroscopy of III-nitrides doped with lanthanides for LEDs and laser diodes, phosphors, photovoltaics and diluted magnetic semiconductors. Role that these materials play in emerging areas of nanotechnology is also a research interest of his. He is a member of APS, MRS, OSA and IEEE. He received the Young Scientist Award, E-MRS 2000, Strasbourg, France, the 2001 Smith Memorial Engineering Award and the 2011 & 2015 Marvin E. & Ann D. White Research Awards from Ohio University. He is a recipient of the 2011 NSF CAREER award for study on III-nitride quantum structures doped with lanthanides. He serves as an Associate Editor for *Journal of Electronics Materials*. Currently in addition to his faculty position in Ohio, he holds a Visiting Research Professorship at the University of Puerto Rico, Rio Piedras, Puerto Rico (U.S.A).



**Tiju Thomas** is currently working as an Assistant Professor at the Department of Metallurgical and Materials Engineering in Indian Institute of Technology Madras (IITM) in Chennai, India. Before coming to IITM, he was working as a Faculty Fellow at the Indian Institute of Science,

Bangalore. Prior to that he was on industry-academia joint project involving University of Toronto, Memorial University of Newfoundland, and Lumentra Inc. Prior to that he was pursuing his graduate degrees at the School of Engineering in Cornell University. His research group ("*Applied Nanostructure and Nanochemistry*") focuses on developing compositionally complex oxides, oxynitrides, nitrides and nanometals, for achieving engineering ends. Problems concerning functional properties of materials are of abiding interest to his group. In particular solar energy harvesting, efficient light emission systems and remediation materials have been the group's recent focus. His group tends to enjoy working with students, and collaborates with faculty members and industrial engineers with very diverse backgrounds. An "applied" approach to materials science makes the group's work very relevant to contemporary technology.

## Course Coordinator

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