Fundamental and Practical Aspects of Heusler Alloys [171005M03]

September 4, 2017 – September 9, 2017

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Overview

In 1903, German mining engineer Friedrich Heusler discovered that a Mn-Cu bronze being alloyed with aluminium or tin demonstrates well-defined magnetic properties despite the fact that none of the constituting elements were ferromagnetic. Now a days, the family of Heusler alloys consists of more than 1000 members and enjoys rapidly growing attention due to a number of exceptional properties of fundamental and practical interest they exhibit. Representatives of the Heusler alloys family are known to demonstrate - enormous (over 10%) *magnetic field induced strains*, a *huge exchange bias effect*, the *record value of inverse magnetocaloric effect*, the *highest (at temperatures above 900 K) thermoelectric figure of merit*. These effects can find a variety of practical applications in sensors and actuators, in energy saving magnetic cooling technology and in direct conversion of waste heat into electricity by means of thermoelectric generation technology. This course is devoted to the basic physical properties and descriptive explanation of the rich variety of phenomenon observed in the Heusler alloys.The primary objectives of the course are to provide clear insights into the following issues:

i) Main features of crystal structure, magnetic properties and electronic structure of full- and half- Heusler alloys and compounds with inverse Heusler structure,
ii) Underlying physics of the huge magnetic field-induced strains and the giant magnetocaloric effect,
iii) Perspectives of the Heusler alloys for applications in novel spintronic devises,
iv) Rational design of Heusler alloys with desired properties: examples from magnetic shape memory alloys, thermoelectrics materials and spin-polarized systems.

Modules	**A: A rich variety of Heusler alloys: crystal structure, structural ordering and magnetism** **B: Heusler-based ferromagnetic shape memory alloys** **C: Heusler alloys for spintronic applications** **D: Heusler alloys as prospective thermoelectric materials**
You Should Attend If…	• You are a Students of B. Tech/MSc/MTech/PhD • You are a Young faculty member or postdoc from reputed academic and technical institutions • You are a Material scientist interested in the various aspects of functional materials • Everyone interested in magnetic shape memory, spintronics and thermoelectricity
Fees	The participation fees for taking the course is as follows: **Research Scholars / Students (non IIT D) : INR 5000** **Faculty ((non IIT D) : INR 10000** **Working Professionals: INR 15000** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Prof. Vladimir Khovaylo received the M.S. degree from M.V. Lomonosov Moscow State University, Russia, in 1997 and Ph.D. degree from Tohoku University, Japan, in 2002. Currently he is a Professor of Materials Science and also the Deputy Director of the Centre for Energy Efficiency Research and Education National University of Science and Technology "MISiS", Russia. He was a visiting professor at University of Duisburg-Essen, Germany (2006), Oviedo University, Spain (2007), an invited professor at Tohoku Gakuin University, Japan (2008) and a JSPS distinguished researcher at Tohoku University, Japan (2010). In 2016, he was recognized as the Best Research Professor of the National University of Science and Technology "MISiS". From 2017, Prof. Khovaylo is the corresponding member of the International Thermoelectric Academy. His research interest includes ferromagnetic shape memory alloys, Heusler compounds and nanostructured thermoelectric materials.

Prof.Ratnamala Chatterjee is Professor in the Physics Department of Indian Institute of Technology, Delhi. She has got several national and international projects and has guided more than 20 Ph.D students, in research areas like *Magnetoelectric Multiferroic materials*, *Topological Insulators*, ***Heusler alloys for Shape memory, magnetocloric & Spintronics applications***, *Shape memory in ceramics* & *Microwave absorbing materials*.

Course Co-ordinator

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