PONDICHERRY UNIVERSITY

DEPARTMENT OF PHYSICS

Invited Lecture

on

"R&D on materials for magnetic functions – An overview on the past and present status at DMRL, Hyderabad"

by

Prof S.Pandian

Defence Metallurgical Research laboratory,
DRDO, Min. Of Defence, Hyderabad

Date: 18th March2016 (Friday)
Time: 4:00 p.m.
Venue: Raman Seminar Hall, Department of Physics

All are Welcome

Alok Sharan
Dr Alok Sharan
(Seminar Coordinator)

Prof Ramaswamy Murugan
Professor & Head of the Department
Department of Physics
Pondicherry University

Dr. RAMASWAMY MURUGAN
PROFESSOR & HEAD
DEPARTMENT OF PHYSICS
PONDICHERRY UNIVERSITY
PUDUCHERRY - 605 014.

R&D on materials for magnetic functions – An overview on the past and present status at DMRL, Hyderabad.

S.Pandian, Defence Metallurgical Research laboratory, DRDO, Min. Of Defence, Hyderabad

Abstract

Magnetic materials are known to play a key role in the industrial development, so much so, its quantum consumption becomes the index of development of a country. The gradual evolution of magnetic materials for different magnetic functions in the last century portends a vibrant global matrix to discover newer materials in this century and explore simultaneously newer applications, hither to, never visualized feasible. While the application domain for magnetic materials is broader and ever expanding, especially in civilian sectors, its relevance to strategic sectors is most crucial. It is in this context, when DMRL was established at Hyderabad in 1963, a research group was set up to pursue R&D on magnetic materials of interest to Defence and also to other strategic departments. In its earlier existence, the group ventured into development of both soft and hard magnetic materials critical to Defence, the success of which eventually led to transferring the technology to MIDHANI, a newly formed Defence PSU in late 1970s for large scale production of specialty alloys. The global announcement on the discovery of $SmCo_5$ magnets around this period attracted the attention of the group and gradually an intensive R&D was focused on establishing a technology to make this class of magnets indigenously. Subsequently, the group went whole hog and developed the technology for making Nd-Fe-B magnets and sm_2Co_{17} – type magnets, and gained expertise not only in magnet processing but also in the development of prototype magnets for specific device applications. DMRL stands today as an R&D centre that pioneered the indigenous development of rare earth magnets in the country and is currently poised to transfer the technologies for setting up a production plant and meet the demand for strategic applications.

In the last one decade or so, the focus of research was diversified into other materials for varied magnetic functions such as magnetostriction, ultrasoft magnets, magnetic shape memory, magnetic caloric, multiferroic, spring exchange coupled permanent magnet etc. In each of these materials, the research effort undertaken brought in a measure of success. Identifying the technological advancement in the use of magnetic materials in small volume, an R&D programme was launched in this group a few years ago, aiming to raise an infrastructure needed to produce and characterize magnetic materials in thin film form. The successful completion of the project culminated in producing both metallic and ceramic thin films for various magnetic functions such as magnetic field sensing, magnetic actuation, mechanical propulsion, energy harvesting and mechanical sensing etc.

An overview of the R&D pursued at DMRL in the past and in the present will be covered in the presentation.

Dr.S.Pandian is a senior scientist from DMRL, and currently heading the group "Advanced Magnetics". Prior to joining DMRL in 1983, he did M.Sc. in Material Science at P.S.G. College of Technology, Coimbatore and M.Tech in Metallurgical Engineering from IIT, Kanpur. While serving at DMRL, he did Ph.D. at IIT, Madras and received the degree for the thesis work he submitted on Nd-Fe-B magnets. His core interest lies in rare earth magnetic materials and its application engineering.

He considers himself fortunate to have associated with the development of Nd-Fe-B magnets at DMRL, early in his career, which brought to him a rich diversity of knowledge in magnetism and in processing & characterization of magnetic materials. He recalls vividly the achievements made in establishing the Nd-Fe-B technology and in the TIFAC sponsored programme of Home Grown Technology that eventually resulted in technology upscaling and its transfer to MIDHANI, defence public sector unit located next premise to DMRL.

The ASEAN-India international cooperation in science & technology provided him ample opportunity to interact with scientists of international repute, outside India.

Currently, on the research front, he is focused on achieving further enhancement in the capability of the rare earth magnets such $SmCo_5$, Sm_2Co_{17} and Nd-Fe-B that were already progressed to a greater extent, and on techno-managerial front, concentrating on transferring the technology of making these magnets to M/s Indian Rare Earths Ltd., a public sector unit under Dept. Atomic Energy.

He has more than fifty publications in refereed journals and several technical reports. Some of his papers on Nd-Fe-B and RFe_2 materials received high citation.

Awards

For the development work done on Sm_2Co_{17} magnets and for qualifying them to be successfully used in the fabrication of bldc motors by NSTL, a sister lab. of DRDO, he shared **the DRDO Best Innovation / Futuristic Development Award 2012.**

For the research work on Nd-Fe-B magnet, he was conferred with the **"Young Researcher Award" by IUMRS 1999.**

He has received best paper awards of **DMRL, IIM, MRSI** on different occasions.

Recently he was honoured by the DRDO with presentation of "Science day Oration Medal" for the year 2016.

Technical Societies:

He has a long association with the **Magnetics Society of India**, established at DMRL, and served the Society taking many roles such as **Editorial Member of its Publication, its Treasurer and Jt. Secretary.** Currently, serving as its **General Secretary**, he ensured organising the Society's conference every year in the last five years, at various centres in the country - the last three being international. The penultimate one was held jointly with Dept. of Physics, Pondicherry University as "ICMAGMA2015"in Sep. 2014, that brought him in close contact with the faculties and research scholars of this department.

He promoted MSI to be recognized even at the international arena, claimed the membership for the Society in Asian Union of Magnetics Societies, hither to represented by the Magnetics Society of each of the countries Japan, Korea, Taiwan and China.

He is also a member of several technical societies such as Indian Institute of Metals(IIM), Materials research Society of India(MRSI), Powder Metallurgical Association of India(PMAI), Rare Earth Association of India(REAI) etc. For the expertise he gained in the use of rare earths for engineering applications, he is honoured to serve as the Executive Committee Member of the Rare Earth Association of India.