

Kalpakkam & Chennai Chapters of  
The Indian Institute of Metals

Cordially invite you  
to

**Dr. Placid Rodriguez Memorial Lecture - 2015**



05.10.1940 - 31.08.2008



by

***Dr. G.K. Dey***

Distinguished Scientist & Associate Director, Materials Group,  
Bhabha Atomic Research Centre, Mumbai

on

**Development of Alloys for Application in the  
Nuclear Energy Sector: Some New  
Perspectives**

***Presidential Address***

***by***

***Dr. S.A.V. Satya Murty***

Distinguished Scientist & Director,  
Indira Gandhi Centre for Atomic Research, Kalpakkam

on

**5<sup>th</sup> October, 2015 (Monday) at 11.00 hrs**

in

**Sarabhai Auditorium, IGCAR, Kalpakkam**

-PRML Committee

# Dr. Placid Rodriguez Memorial Lecture

Organised by Kalpakkam & Chennai Chapters of  
The Indian Institute of Metals



05.10.1940-31.08.2008



To perpetuate the strong scientific spirit and the value system which Dr. Placid Rodriguez practiced during his life time, “Dr. Placid Rodriguez Memorial Lecture” was instituted by The Indian Institute of Metals (IIM), in 2009, under the pioneering leadership of Dr. Baldev Raj, Director, National Institute of Advanced Studies, Bangalore. Since then, this event is being organised annually by the Kalpakkam and Chennai chapters of The IIM.

The previous Placid Rodriguez Memorial Lectures were delivered by

- ❖ Prof. Atul Chokshi, Indian Institute of Science, Bangalore (2009)
- ❖ Prof. Seeram Ramakrishna, National University of Singapore (2010)
- ❖ Dr. Srikanth, Director, NML, Jamshedpur.(2011) and
- ❖ Prof. B.S. Murty, IIT, Madras (2012)
- ❖ Prof. Indranil Manna, Director, IIT Kanpur (2013)
- ❖ Dr. Amol A. Gokhale, Director, DMRL Hyderabad (2014)

Dr. Placid Rodriguez, born in Quilon, Kerala on October 5, 1940, obtained his B.Sc. from Kerala University, B.E.(Metallurgy) from the Indian Institute of Science, Bangalore, M.S. from University of Tennessee, USA, Ph.D. from IISc and MBA from IGNOU. He joined the Department of Atomic Energy in 1960 and moved to The Indira Gandhi Centre for Atomic Research, (then known as Reactor Research Centre) in 1974. He established one of the leading metallurgical research laboratory at Kalpakkam. He was Director of IGCAR, Kalpakkam from 1992 to 2000. Subsequently he served as the Chairman, Recruitment and Assessment Centre, DRDO, Delhi and Raja Ramanna Fellow and AICTE-INAE Distinguished Visiting Professor at IIT, Madras.

Dr. Placid Rodriguez had an exemplary career of four decades, leading research in metallurgy, materials development for fast reactor programme of our country, shaping up human resources in defence programme and academic institutions.

Dr. Placid Rodriguez has been a member of Editorial Board of several reputed international journals in Metallurgy and Materials Science and was the Chief Editor of Transactions of The Indian Institute of Metals. Dr. Placid Rodriguez served as the President of many leading national, professional institutes. Dr. Placid Rodriguez has been a recipient of many national and international awards. He has been a Fellow of many prestigious Academies of our country.

Dr. Placid Rodriguez passed away in Chennai on 31<sup>st</sup> August, 2008.

### **About Dr. G.K. Dey**



Dr. Gautam Kumar Dey obtained his B. Tech in Metallurgical Engineering in 1979 from the Indian Institute of Technology, BHU and was awarded the gold medal for standing first. He joined the 23rd batch of Training School in Bhabha Atomic Research Centre (BARC) and was awarded the Homi Bhabha prize for standing first in his discipline. On completion of training, he joined Metallurgy Division of BARC. He obtained his Ph. D degree from Banaras Hindu University in 1988. He was a postdoctoral fellow at University of Cincinnati from 1994 to 1996. He has been Visiting Scientists at University of Osaka, Japan and Institut für Festkörperforschung (IFF), Juelich, Germany. He has won several awards for his scientific contributions. Of these mention can be made of the Young Scientist award of Indian National Science Academy (1989), Young Metallurgist Award given by Ministry of Steel and Mines (1989), MRSI Medal given by Materials Research Society of India (2001) and Metallurgist of the year award given by Ministry of Steel (2003), the Vasvik Award (2006), the G D Birla Gold Medal of Indian Institute of Metals (2011) and the Distinguished Alumnus Award of IIT BHU. He is a fellow of the Indian National Academy of Engineering (INAE), Indian Academy of Science (IAS) and Electron Microscopy Society of India (EMSI). He is associate editor of Transactions of the Indian Institute of Metals. Areas of his research interest are Phase Transformation in Zirconium and Nickel Base Alloys, Amorphous Alloys, Rapidly Solidified Crystalline and Quasicrystalline Alloys, Electron Microscopy and defect Characterization and High Resolution Electron Microscopy. He has more than 300 scientific publications in peer reviewed journals to his credit. He is a Distinguished Scientist, Professor and Dean-Academic (Engg. Sci.) for BARC in the Homi Bhabha National Institute. He is currently the Associate Director, Materials Group, BARC and Head, Materials Science Division, BARC.

# **Development of Alloys for Application in the Nuclear Energy Sector: Some New Perspectives**

**G.K. Dey**

**Bhabha Atomic Research Centre, Mumbai**

## **Abstract**

Uninterrupted operation of nuclear reactors is highly dependent on the performance of the structural materials which have to perform under severe service environments. In this respect any alloy which could be considered for structural application in a nuclear reactor has to have high corrosion resistance, adequate mechanical strength at elevated temperatures and should withstand all deleterious irradiation effects. Optimization of the desired properties in the chosen alloy requires control of the microstructure, which depends on manufacturing (casting, forging, heat treating, etc.) and fabrication (welding, etc.) processes. This microstructural control is not a trivial task in modern alloys. Many a time during processing of an alloy, if time and temperature window is not selected properly, it leads to the formation of unintended phases during solidification, heat treatment or fabrication, often in structurally compromising microstructural locations like grain boundaries severely affecting the performance of the alloy during its service. Furthermore, the local redistribution of critical alloying elements during welding can reduce the local corrosion resistance of an alloy below that of the bulk material. Understanding microstructural and texture development in an alloy system becomes critical in designing new alloy compositions or optimizing processes for manufacturing. This can be time consuming and costly. This presentation describes the alloy development strategies first, which can be essentially put into three different categories; (i) replacement of commercially imported alloys with indigenous alloys having similar or better properties, (ii) development of new alloys using empirical approach and (iii) development of new alloys using ab-initio approach. Even in reproduction of the already developed alloys which could replace the imported alloys, large number of iterations may be needed. However, with modern characterization tools and extensive background knowledge about microstructure, deformation behaviour and textural development in related alloy systems, time and manpower requirements can be drastically cut down. Scientists have a very vast knowledge bank in this country about various alloy systems and excellent capability and availability of different analytical tools. These have greatly facilitated alloy development by the first route. This presentation will give many examples to elucidate this in the case of recent indigenous development of Zr based alloys, Nb based alloys, steels and nickel based alloys. Results on structure property correlation in these alloys, effects of neutron irradiation and proxy ion irradiation have been highlighted. Development of new alloys by empirical approach needs synthesis of several alloys and testing their suitability for a particular application. Though a beginning has been made in the third route of alloy development, considerable efforts are still needed in attaining the capability of predicting deformation behaviour of multiphase and polycrystalline alloys.

# Dr. Placid Rodriguez Memorial Lecture - 2015

## PROGRAMME

**Date** : 5<sup>th</sup> October, 2015 [Monday]  
**Venue** : Sarabhai Auditorium, IGCAR, Kalpakkam  
**Time** : 11.00 hrs

**Welcome Address** **Dr. U. Kamachi Mudali**  
Member, PRML Committee  
Outstanding Scientist & AD, CSTG, IGCAR, Kalpakkam

**About Dr. Placid Rodriguez Memorial lecture series** **Prof. M. Kamaraj**  
Member, PRML Committee  
Dept. of Metallurgical & Materials Engg., IIT Madras

**Presidential Address** **Dr. S.A.V. Satya Murty**  
Distinguished Scientist & Director ,  
Indira Gandhi centre for Atomic Research, Kalpakkam

**Introducing PRML Speaker** **Dr. S. Venugopal**  
Outstanding Scientist & Director, MMG, IGCAR, Kalpakkam

**Dr. Placid Rodriguez Memorial lecture** **Dr. G.K. Dey**  
Distinguished Scientist & Associate Director, Materials Group,  
BARC, Mumbai

***Development of Alloys for Application in the Nuclear Energy Sector:  
Some New Perspectives***

*Presentation of Award  
by*

**Dr. S.A.V. Satya Murty**

Distinguished Scientist & Director, Indira Gandhi centre for Atomic Research, Kalpakkam

**Vote of thanks** **Dr. Rani P. George**  
Convener, PRML 2015  
IGCAR, Kalpakkam

***High Tea at 10 30 hrs at Sarabhai Auditorium Foyer***

**- PRML Committee**

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