



## In memorium

Professor Kadavil Poulose Abraham, a doyen of metallurgical education and research and an international authority in the field of extraction and process metallurgy in general and chemical thermodynamics in particular, passed away peacefully at his home in Bangalore on 23 December, 2011, at the age of 91.

Abraham was born on 28 August, 1920 at Trichur, Kerala and obtained his BSc from London University in 1941 as an external degree from University College, Colombo (Sri Lanka). Subsequently he joined the University of Lucknow and obtained the MSc degree in Chemistry in 1944. After a brief stint as Lecturer at Maharaja's College, Ernakulum, he went back to Sri Lanka and joined Jaffna College as a Lecturer in Chemistry in 1947. In 1956, he joined the Nuffield Research Group in Extractive Metallurgy at the Department of Metallurgy, Imperial College, London to pursue his doctoral studies under the supervision of Professor F D Richardson, a giant in the field of extractive metallurgy. He was awarded the PhD degree from the University of London in 1959, for his seminal work on the thermodynamic properties of iron and steel making slags. After a year of post-doctoral research at the Imperial College, Abraham returned to India and joined the Department of Metallurgy, Indian Institute of Science, Bangalore, as an Assistant Professor in 1960 and rose to become Professor in 1970. In 1972, he was appointed Professor-in-charge of the Department and served as the Head until 1977.

At the Department of Metallurgy, Professor Abraham was instrumental in starting the ME degree programme in chemical and physical metallurgy. He established an extractive metallurgy laboratory and built several specialized equipment for basic research in high temperature thermodynamic and kinetic measurements encompassing reduction of oxides, roasting of sulphides, calorimetric studies of slags, and activity measurements using solid electrolytes. His emphasis on quantitative measurements and scientific analysis of processes provided an impetus for the evolution of the burgeoning metallurgical industry in India. As an industrially oriented academician, Professor Abraham designed and built a pilot scale electro-slag remelting unit for steel, which was used to develop the process parameters for the manufacture of inclusion-free steels for the aeronautical, space and defence industries. Professor Abraham's pioneering studies on the sulphur capacity of slags for steel making have been widely cited and are highly acclaimed. He has published over 100 technical papers and has co-authored a book on 'Extraction of Nonferrous Metals', which is a prescribed text for undergraduate metallurgy programme. He has guided a dozen PhD, and numerous ME, MSc (Engg.) and BE students. He has held visiting Professorships at the Royal Institute of Technology, Stockholm, Sweden, University of Toronto, Canada and the Pennsylvania State University, USA. Even after his superannuation from the Institute in 1981, he was a consultant to several organizations such as the Regional Research Laboratory, Trivandrum, Research and Development Centre for Iron and Steel (RDCIS), Ranchi, and the Aluminium Association of India (AAI), Bangalore. He was the Editor of Aluminium India (1989-2007), published by the AAI and was

a member of the Scientific Advisory Committee, Ministry of Steel and Mines (1984-'88) and of the Action Group of the Union Steel Ministry (1985) to implement strategies to revitalize the steel industry.

Professor Abraham has been recognized worldwide with many awards, prizes and honours including the Fellowship of the Indian Academy of Science, Extraction and Processing Science Award of the Minerals, Metals and Materials Society (TMS), USA, Honorary Member of the Indian Institute of Metals, to cite a few. He was one of four living scientists honoured for pioneering contributions in the field of extractive metallurgy in the last century at the International Conference on Molten Slags, Fluxes and Salts held in Stockholm in 2000.

Professor Abraham had been a very distinguished father figure of metallurgy in India and his name is synonymous with "thermodynamics". Several generations of BE, ME and PhD students have immensely benefitted by his great erudition, sagacity, innate hospitality and philosophical outlook. Many of his students are professionally well accomplished in different parts of the world and all of them owe it to Professor Abraham. His commitment and enthusiasm for research and teaching remained undiminished till the end and he did not hesitate to participate in Conferences, chair sessions or share his knowledge despite his advanced years. He had a disarming smile and anyone who came in contact with him was readily struck by his humility and affection. He was a karmayogi, a gnanayogi and a stithapragnya and always in a state of true thermodynamic equilibrium.

Professor Abraham admirably managed a fit and a very healthy life and despite his age was young in spirit and keen to keep abreast of the developments in the Department of Metallurgy, the faculty, staff and students.

He will be greatly missed by all of us, his colleagues and former students around the world but especially by his wife Sarala Abraham and sons Ranjan and Sajjan.