"Many operating nuclear power plants in India would be looking for students"

Dr. K. Linga Murty
Professor of Nuclear Engineering, Professor of Materials Engineering

Education

BSc (Physics), Andhra University, India, MSc (Physics), Andhra University, India, MS (Materials Science), Cornell University, PhD (Materials Science), Cornell University.

Profile

Professor Linga Murty is recognised for his outstanding contribution to deformation and formability of Zirconium alloys; application of textures in predicting in-reactor cladding performance, radiation effects on the fracture behavior of nuclear structural alloys and synergistic effects of radiation-induced defects and impurities and development & application of non-destructive testing in characterising condition of materials in service. He has been elected as Fellow of the American Nuclear Society (ANS) and has been the recipient of the ANS-Mishima award.

Due to the recent Indo-US nuclear agreement, there has been a lot of speculation among students who are interested in Nuclear Sciences on the future of educational opportunities in the area. In this issue on Nuclear Engineering, TGE has compiled details that will answer the queries of all such aspiring students. And who better than an Indian who has made it big in this field in the US?

Dr K.L. Murty, **professor in Nuclear Engineering and Material Science and Engineering in North Carolina State University tells us how Nuclear Sciences has scope for growth and offers ample opportunities to its aspirants.**

How did you discover your interest in Nuclear Engineering?

It all came as an interesting coincidence and timely opportunity. I need to go through a brief description of the events that led to this. I had my undergraduate and graduate degrees in Physics - BSc (Hons) and MSc from Andhra University, India. In 1964, I joined Cornell University as a graduate teaching assistant in the Physics department. This was after my MSc in Physics in 1963 from Andhra University. I spent a year as a research scholar in the Physics department at IIT-Bombay. In the summer of 1965, I got an opportunity to work with Prof. A.L. Ruoff of the Materials Science and Engineering Department as a research assistant where I started working on 'creep of-iron' - a subject in mechanical metallurgy that got me my MS degree in Materials Science from Cornell in 1967.

After that, I continued studying at Cornell for my doctorate degree with Prof. Ruoff but switched to Applied Physics. I worked on NMR under hydrostatic pressure in LiBr single crystals. Following my PhD in 1969, I spent about 11 months as a post-doctoral fellow in the Physics Department at Rennseallar Polytechnic Institute, Troy, NY and later moved to the University of California, Berkeley to work with the late Prof. John Dorn in Materials Science and Engineering as a research metallurgist. This project was funded by the Lawrence Berkeley Laboratory and I worked on creep

and superplasticity. From 1972 to 75, I was an AINSE fellow in the Metallurgy Department at the University of Newcastle, Australia where I worked with Prof. E.O. Hall on the effects of neutron radiation on yield point phenomena in steels, following which I returned to the US to work first at Lynchburg Research Center of Babcock & Wilcox Co. (1975-79) and Westinghouse Research Center in Pittsburgh, PA (1979-81). This 7-year stint in industrial R&D was on nuclear materials such as Zircalloys and steels that are commonly used in nuclear reactors. In 1981, I got this opportunity to be a faculty member in Nuclear Engineering and Materials Science & Engineering. I initially hesitated to take up this challenging job, especially because I did not have the background or academic training in both the subject areas, though I had considerable research experience in them. It was at first a gruelling experience to start teaching subjects in Nuclear Engineering (Nuclear Materials) and Materials Engineering (Fundamentals of Materials Science and Mechanical Metallurgy) but, since they are all closely connected with my research, it turned out to be a very fruitful experience and the synergy between teaching and research helped in both aspects of my academic career.

I was fortunate to get a funding that helped develop an active research programme in Nuclear Materials that comprised nuclear materials research (funded by related nuclear industries and the US department of energy) and materials-related research, which was funded by the US National Science Foundation.

It is believed that Nuclear Engineering, being a sensitive research area, is still not very open to admitting many international students how true is this?

This is not true at all since a majority of the research in academic institutions is 'very open' and we constantly publish our results in open literature. There are many international students in all the Nuclear Engineering departments in the US. In fact, until a couple of years ago, a majority of our students were from abroad, although we strive to recruit US nationals. The trend is changing mainly due to the resurgence of nuclear energy and the increased opportunities because of the increase in federal government support for new and advanced reactors and also because many senior personnel in the related fields have retired. A majority of the research and teaching subjects are on nuclear energy, applications of nuclear techniques in biomedical, national security, etc. and are not related to weapons.

In India, there are no institutions offering a UG programme in Nuclear Engineering. Are US schools open to admitting students from other departments like Chemical Engineering, Electrical Engineering, Mechanical Engineering and Material Science and Engineering?

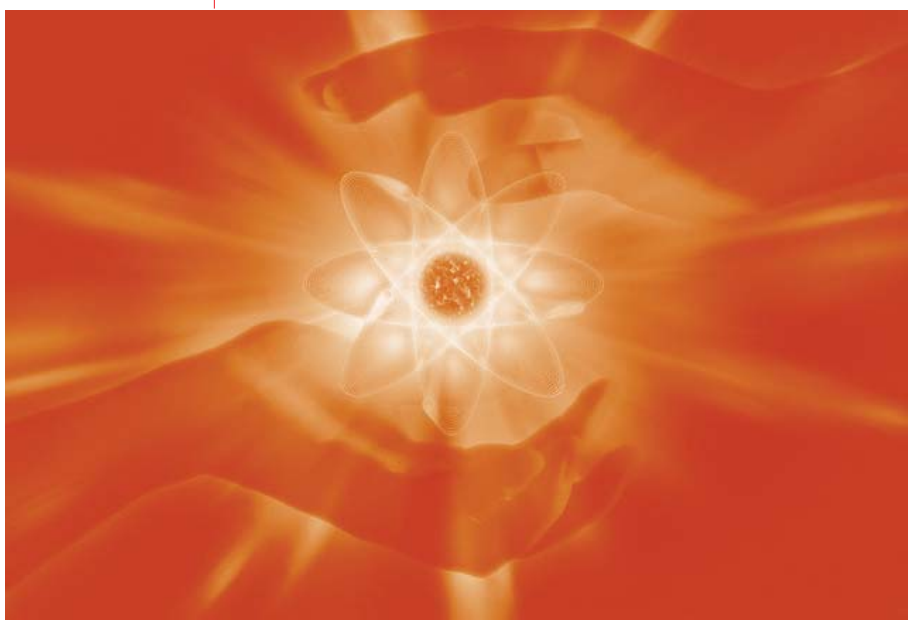
Yes, US universities are open to admitting students from varied backgrounds and many of them occasionally need to take some compensatory courses before embarking on graduate work. Those (from India) who joined NE departments mainly come from Mechanical Engineering, Nuclear Physics and some from Materials Science and Engineering. It is true that India has no institution offering Nuclear Engineering degrees, especially at the UG level, which actually resulted in a relatively small number of Indian students applying to NE programmes. Whereas countries such as China, Korea and Japan as well as some in Europe do offer NE degrees and students from these countries join various NE departments here.

What are the major research areas in the field of Nuclear Engineering?

One can classify these areas into 4 broad ones: Fission-related (reactor engineering, thermal hydraulics, fuel optimisation, nuclear materials), Radiation Measurement and Detection (prompt gamma-ray neutron activation, development of techniques and applications in varied technologies including oil well logging), Fusion and Plasma related (plasma diagnostics, plasma-materials interactions etc.) and Radiological Sciences (nuclear waste management, risk assessment, radiological health, etc.)

How do you see this field growing in the coming years?

As I mentioned earlier, there is



especially in my case as it actually brought varied honours and awards for my research both from the American Society for Materials International and American Nuclear Society as well as from the Indian Institute of Metals. Teaching at varied levels (UG, Graduate and advanced Graduate) helped me with research and vice-versa where some of the research findings are brought into course-work.

currently a very optimistic outlook for NE in the US. Recent price increases in oil and the search for alternate energy sources, the need to reduce environmental pollution, acid rain and the positive change in public opinion about nuclear energy are paving the way for nuclear energy to make a comeback. Also, in recent years, the American government is looking for advanced nuclear energy concepts that are more efficient, proliferation-resistant and create minimal radioactive waste. Therefore, there will be increased funding for the development of new generation i.e. Gen IV reactors and for the Global Nuclear Energy Programme (GNEP). The current phase can be described as a 'nuclear renaissance'. I also wish to add here, that in the last few years, the majority of the currently operating reactors (more than 100) in the US have received life extensions. A further continuation of this older fleet of reactors requires additional research and testing. Similarly the new advanced reactors also call for extensive research programmes in all the related nuclear engineering fields like materials - where they are exposed to very high temperatures and in radiation fluences along with extended life times (60 years vs current reactors with 40 year life). More importantly applications of NE in biomedical sciences are being appreciated by the community and that needs a development of multidisciplinary teaching and research with bio-emphasis.

As an academician, how has your experience been in teaching and research?

I never regretted my move to academia following the industrial experience, though, quite often, the research funding and changes in their trends make it difficult to sustain a research programme(s). My own research and teaching have helped each other - as I mentioned earlier there is synergy between the two,

What would you advise the students aspiring to get into this field?

There are multi-faceted opportunities for students in NE; however, the field is multi-disciplinary and requires sound mathematical foundation as well as an understanding of physical sciences concepts. This is not an easy curriculum since it cuts across atomic and nuclear physics, thermodynamics and thermal hydraulics, instrumentation as well as materials. A good student who wishes to get a wide and in-depth knowledge in all these areas is well advised to pursue this field. If students from India would like to get an advanced degree here in the US in NE and would like to go back home, they would find good opportunities with atomic energy related areas such as those found as BARC, IGCAR, NFC and some of the new research and development centres that are in the pipeline in India. I am sure the many operating nuclear power plants in India would be looking for such students with knowledge in NE. ■