



## **Utilisation of Kamini Reactor for Neutron Radiography and Activation Analysis**

**R. R. Ramanarayanan, P. V. Ramalingam, R. P. Kapoor**

### **Abstract**

Kamini reactor is a Uranium-233 fuelled, demineralised water moderated and cooled beryllium oxide reflected, low power research reactor located in the post irradiation examination facility of Radiometallurgy Laboratory, Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu. The reactor was built and commissioned jointly by Bhabha Atomic Research Centre and Indira Gandhi Centre for Atomic Research. The reactor attained first criticality on 29<sup>th</sup> Oct '1996 and is licensed for regular operation at its nominal power of 30 kWt from Jul '1998.

The reactor functions as a neutron source with a flux of  $10^{12}$  n/cm<sup>2</sup>/s at core centre and facilitates carrying out neutron radiography of radioactive and non-radioactive objects and neutron activation analysis of variety of samples. Experimental facilities consist of three beam tubes with a flux of  $10^8$  n/cm<sup>2</sup>/s, one of them equipped with special setup for radiography of irradiated elements. There are two locations outside the reflector in the reactor tank for irradiation of larger samples at a flux level of  $10^{10}$  n/cm<sup>2</sup>/s and one location at the reactor core periphery for short irradiation at a flux level of  $10^{11}$  n/cm<sup>2</sup>/s using pneumatic sample transfer system.

After commissioning the reactor, the neutron beams from two beam tubes were characterised to assess the radiographic parameters and techniques. The south beam tube with an L/D ratio of 200 has been extensively utilised for neutron radiographic experiments. Recently, neutron radiography of three irradiated fuel pins of Fast Breeder Test Reactor (FBTR) with 50,000 MWd/t burn up, has been carried out. The neutron beam has also been utilised for qualification of a number of pyrodevices namely cable cutter, bolt cutter, detonating cartridges from Department of Space through neutron radiography. Real time neutron radiography providing on line image of the specimen has also been tested and real time radiographs of dummy FBTR fuel pin and PHWR fuel pin were taken. So far about 765 neutron radiographs of various components including turbine blade and spark plug have been generated. Image quality was found to be good.

The reactor also has served as an irradiation tool for activation analysis of samples from both in-house and outside agencies. Many samples from Tamil Nadu Forensic Laboratory have been tested in Kamini for forensic examination. Other samples include ore specimen from Ore Dressing Section, BARC, sediments from Palar river bed for analysis of trace elements. So far about 314 samples have been irradiated including some classified samples.

To enhance the utilisation of Kamini for various Non-destructive examination, a workshop on KAMINI UTILISATION was organised in 1999 with participation from large number of institutions and many experiments on radiography and activation analysis were demonstrated to the participants.

This paper describes the Kamini neutron source facility, various locations available and their characterisation for carrying out neutron radiography and activation analysis and typical results obtained. Steps taken to increase its utilisation are also mentioned.