Contribution ID: **504** Type: **ORAL**

Root Cause Analysis of FBTR Failed Fuel Pin

Thursday, 21 April 2022 11:52 (12 minutes)

The Fast Breeder Test Reactor (FBTR) at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, is a loop type, sodium cooled fast reactor. Its main aim is to provide experience in fast reactor operation, large scale sodium handling and to serve as a test bed for irradiation of fast reactor fuels & materials. India has been operating FBTR with Mixed Carbide Fuel as the driver fuel since 1985. Mixed Carbide was chosen as the fuel due to its high stability with Pu rich fuel, compatibility with coolant and for its better thermal performance. Being a unique fuel of its kind without any irradiation data, it was decided to use the reactor itself as the test bed for this driver fuel. The fuel has performed extremely well, with the peak burn-up reaching 165 GWd/t. In the year 2011, MK-1 fuel SA that reached 148.3 GWd/t burnup in III ring of FBTR core had a single pin failure which was identified by both cover gas detectors as well as bulk DND detectors. Subsequently, Post Irradiation Examination (PIE) was carried out on the Failed Fuel Subassembly. Various possible causes of fuel pin failure in the SA were postulated.

One of the initial causes of failure was identified as flow reduction through the SA which was studied and ruled out by a detailed analysis. Also, deformation caused in the fuel pin geometry due to high irradiation dose, results in only 4 % reduction in flow through the SA. Subsequently, a detailed analysis of the failed fuel pin has been carried out for the estimation of Fission gas pressure & FCMI induced stress, clad strains, Clad Cumulative Damage Fraction etc. at different axial levels as a function of burnup. Studies were also carried out to find out the reasons for the ovality of the pins after irradiation. Above parameters are analyzed for the Failed fuel SA and the results are compared with first ring MK-1 fuel SA so as to assess whether failed fuel SA has experienced any abnormalities compared to first ring SA. Also, an attempt has been made to bridge the gap areas between the PIE observations and the analysis results of the failed fuel SA to ascertain the reasons for the failure.

Country/Int. organization

India

Speaker's email address

dnsiva@igcar.gov.in

Speaker's title

Mr

Affiliation/Organization

Indira Gandhi Centre for Atomic Research

Primary authors: DUDALA, NAGA SIVAYYA (IGCAR, Kalpakkam); THIRUNAVUKKARASU, RAJKUMAR (IGCAR); AITHAL, Sriramachandra (Indira Gandhi Centre for Atomic Research, Kalpakkam); Mrs R, Vijayashree (IGCAR); S., RAGHUPATHY (Indira Gandhi Centre for Atomic Research, Kalpakkam)

Presenter: DUDALA, NAGA SIVAYYA (IGCAR, Kalpakkam)

Session Classification: 3.2 Development of innovative fuels: design and properties irradiation

Track Classification: Track 3. Fuels, Fuel Cycles and Waste Management