Contribution ID : **5** Type : **Oral**

Development of Neutron Imaging Facility at Dhruva research reactor, India

Tuesday, 4 September 2018 14:50 (20)

A neutron imaging beamline has been set-up at Dhruva research reactor, India. The techniques currently implemented are Neutron Tomography, Neutron Phase Contrast Imaging and Real-Time Neutron Radiography. Combinations of sapphire and bismuth single crystals have been used as filters at the collimator input to reduce the epithermal neutron and gamma contribution respectively. The maximum beam size is restricted to ~ 120mm diameter at the sample position. A cadmium ratio of ~ 250 with L/d ratio of 160 and thermal neutron flux of 4 x 107 n/s-cm2 at the sample position has been achieved. The conventional Neutron imaging is carried out with a lens coupled CCD camera and neutron scintillator, while high resolution neutron image plates (25μm pixel) have been used for carrying out Phase sensitive experiments. Moreover, different scintillator and lens combinations are available to user to select large field of view with moderate resolution or high resolution with small field of view. Operation and control of sample manipulator, Detector, monitoring cameras etc can be remotely carried out from shielded experimental hutch. Different applications in the fields of reactor engineering, material science studies, archaeology, etc. shall be discussed.

We have carried out neutron tomography on Zr-2.5Nb samples containing different amount of hydrogen ingression. This test was used to validate minimum detectable limits for the same at our facility. Further studies on the diffusion of hydrogen in Zr-2.5Nb are underway. Neutron tomography studies on the metallic foam samples were carried out and its mechanical properties were simulated using volume data obtained from tomography experiments. This approach provides a powerful alternative to compare the model manufactured materials mechanical properties and for detection flaws either in the manufacturing or during different stages of its operation. In continuation with our previous work, we have set-up study lead solidification using neutron imaging technique and derived important properties in an accidental scenario.

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Session Classification : Speaker Sessions and Seminars

Track Classification : Instrumentation