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# Performance evaluation of ferroboron shielding material after irradiation in FBTR

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Ferroboron has been identified as a candidate material for in–vessel radiation shielding application in future Fast Breeder Reactors (FBRs) in India that can result in significant cost savings. Out-of-pile physical and chemical characterisation studies have established its neutron shielding property and long-term compatibility with 304L SS clad under sodium at the operating temperatures. An irradiation experiment was designed and carried out with the aim of establishing in-reactor performance of ferroboron shielding material over a target life-time of 60 years. Performance parameters such as slumping of the Ferroboron column, generation of helium gas and extent of ferroboron –clad chemical interaction have been evaluated as a part of Post Irradiation Examinations.

The irradiation capsule was designed to cover a arange of temperature and flux combinations. The ferroboron powder was packed to a known density under high purity argon atmosphere. The capsule was subjected to detailed pre-irradiation checks. The irradiation was carried out in FBTR core to a total fluence corresponding to expected lite-time. After discharge from FBTR the ferroboron capsule was subjected to neutron radiography, released helium measurements and metallography.

Neutron radiography was carried out using an indirect imaging technique. The radiographs indicated that the slumping of the ferroboron stack is limited to a maximum of 1mm in a 100mm pre-irradiation stack height.

The quantity of helium released due to (n,α) reaction is an important paramter of interest since it results in pressure increase in the cladding. The quantity of helium gas released in three sub-capsules was measured. These tests revealed that the maximum internal pressure developed after irradiation is 0.16 Mpa. A few samples of ferroboron clad were extracted for cross-sectional metallography and microstructural examination was carried out to evaluate ferroboron-clad chemical interaction.

PIE of the ferroboron capsule irradiated in FBTR has indicated that this material has performed very well and is a suitable for deployment in future fast reactors. This paper will describe the various examinations carried out and the salient results obtained.

## Country/Int. Organization

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