Contribution ID: **48** Type: **not specified**

Synergistic effect of ion irradiation and LBE corrosion on martensitic steel

Accelerator Driven sub-critical System (ADS) has been considered as a powerful technology for transmuting long-lived nuclides and minor actinides (MAs) [1]. In these systems, a spallation target located inside a sub-critical fast reactor core provides the external source neutrons to drive the operation of the ADS. The neutrons are produced via spallation reaction of high power proton beams colliding with the target material.
The lead-bismuth eutectic (LBE) was commonly selected as the target material and the coolant material due to its higher neutron yield and high good thermal-physical properties. As the most critical component in the spallation target, the beam window will be subjected to intensive irradiation of the proton/neutron mixed spectrum and liquid LBE corrosion. The degradation of mechanical properties of the beam window under such combined harsh environment are essential for the safe operation of spallation target. For the safety and reliability of the target, it is necessary to assess the behaviors of the beam window material under both irradiation damage and molten LBE.
In order to systematically investigate the synergistic effect of irradiation and LBE corrosion on structural materials of the spallation target, the Heavy Liquid Metal and Irradiation Facility (HLMIF) using heavy ion as an irradiation source was constructed in the National Laboratory of Heavy ion Accelerator in Lanzhou. Based on the HLMIF, 247MeV Ar ions was used to irradiate SIMP sample simultaneously exposed to flowing LBE, and a synergistic effect was investigated. The irradiation damage on the interface of the SIMP steel/LBE was 1.36dpa, 4.8dpa and 13.6dpa. The results shows that the Ar ions irradiation not only accelerates the corrosion rate, but also remarkably alters the microstructure of surface oxides compared to the only corroded sample. The mechanism of the synergistic effect will be briefly discussed in this study.
Reference
1. P. A. Gokhale, S. Deokattey, V. Kumar, P. A. Gokhale, S. Deokattey, V.i Kumar, Accelerator driven systems (ADS) for energy production and waste transmutation: International trends in R&D, Prog. Nucl. Energ. 48 (2006) 91-102.

Primary author: YAO, Cunfeng (Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou 73000, China)

Co-author: WANG, Zhiguang (Institute of Modern Physics, Chinese Academy of Sciences, P.R. China)

Presenter: YAO, Cunfeng (Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou 73000, China)

Track Classification: Liquid/solid and particle beam interactions and associated studies: pressure waves, cavitation, erosion, corrosion etc and mitigation techniques.