Seminar

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Institute for Plasma Research

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Title: Investigation of radiation impact on Cu alloys for its application in Beamline components of DNB

Speaker: Dr. Konuru S Lakshmi Kanth
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Date: 20th August 2024 (Tuesday)

Time: 10.30 AM

Venue: Seminar Hall, IPR

Abstract

CuCrZr and Oxygen Free Copper (OFC) are widely used in Beamline components of Neutral beam Injectors of ITER as a structural material. The mechanical performance of the materials are well established. However, in nuclear reactor, material experiences extreme environment. The impact of high energetic radiation on the structural and mechanical properties of the materials needs to be investigated thoroughly. During first year, irradiation experiment was performed for neutron and energetic ion beam on solution annealed CuCrZr alloy. Priliminary characterizations are performed and results will be discussed. Further, analytical activation assessment and defect studies are performed.

Comprehensive damage and activation assessments were conducted on CuCrZr samples utilizing the OpenMC, Specter, and in-house developed ACTYS code, respectively. To validate the analytical observations with experiments, CuCrZr specimens measuring 10 x 10 x 2 mm were precisely fabricated using a wire-cut machine. Subsized Ultimate Tensile Strength (UTS) samples were designed in accordance with ASTM standards and subsequently analyzed using an in-house Universal Testing Machine (UTM). The samples were exposed to 14 MeV neutron irradiation for a duration of 100 minutes at a flux of 5.28×10^{10} n/cm². Post-irradiation characterization involved a comprehensive analysis using Raman spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), optical microscopy, and gamma spectroscopy. The resulting data were compared to the properties of pristine samples to measure the effects of neutron radiation on CuCrZr. In parallel to neutron irradiation, OFC and CuCrZr samples were subjected 150 keV Ar^{2+} ions up to a maximum fluence of 3.6×10^{16} ions/cm^2. Morphological alterations induced by ion irradiation were examined through SEM. To gain a deeper understanding of the defect generation mechanisms and associated changes in mechanical and structural properties, further investigations are ongoing for irradiated and pristine samples. The presentation will be focused on the obtained results and future perspectives.