

Ion-irradiation induced degradation of thermo-mechanical properties of carbon-based materials

Wednesday, 21 May 2014 10:50 (20 minutes)

This work summarizes our latest results on ion-induced degradation of thermal diffusivity and mechanical response of carbon materials for production targets and beam catchers applications in high power accelerator facilities. Investigated materials include graphitic grades like high-density isotropic graphite, flexible graphite and carbon- carbon composites. Irradiations have been performed at the M3 beamline at the UNILAC linear accelerator at GSI, Darmstadt with ^{131}Xe , ^{197}Au and ^{238}U ions with energies between 709 MeV and 1.14 GeV. It is shown that energetic heavy ion-induced structural defects result in an early reduction of thermal diffusivity of graphite. Impact tests using nanoindentation indicate also a radiation induced degradation of impact response and fatigue resistance of graphitic material. Swelling of the irradiated target material induces contours of increased stress at the edge of the beam spot. Thermal conductivity decrease leads also to increased thermal stress adding at the stress concentrators positions. These phenomena together with material embrittlement play the major role in target and beam catcher failure scenarios, during long term operation.

Primary author: Dr TOMUT, Marilena (GSI, Helmholtzzentrum für Schwerionenforschung, Darmstadt)

Co-authors: Mr HUBERT, Christian (TU-Darmstadt / GSI Helmholtzzentrum für Schwerionenforschung); Prof. TRAUTMANN, Christina (TU Darmstadt); Prof. CHIRTOC, Mihai (University of Reims Champagne-Ardenne, France); Dr HORNY, Nicolas (University of Reims Champagne-Ardenne, France)

Presenter: Dr TOMUT, Marilena (GSI, Helmholtzzentrum für Schwerionenforschung, Darmstadt)

Session Classification: Focus Session 2: Radiation Damage and Material Limits

Track Classification: Radiation Damage and Material Limits