Contribution ID: **718** Type: **Oral**

Evaluation of Tungsten as Divertor Plasma-Facing Material: Results from Ion Irradiation Experiments and Computer Simulations

Friday, October 26, 2018 11:25 AM (20 minutes)

Tungsten has emerged as divertor-plasma-facing material in fusion reactors due to its excellent thermal and mechanical properties as well as low tritium affinity. It is therefore essential to understand the behavior of tungsten in reactor-like conditions from the point of view of radiation damage and fuel retention. There is already a world-wide effort in creating a database of radiation damage and retention by surrogate ion irradiation. In this paper, we present results of experiments and computer simulations of radiation damage and deuterium trapping due to light, medium and heavy ions in poly-crystalline tungsten. The idea is to develop a deeper understanding of the radiation damage, evolution of the defects and their impact on hydrogen-isotope trapping.

Several irradiation experiments have been carried out with ions of Au, W, B, He and D of energies ranging from 100keV-80MeV. We have found that for the same fluence (1.3 x 1018 ions-m-2) of the impinging ions, the ion-mass plays a critical role in the defect creation and subsequent deuterium trapping. The samples irradiated with 80 MeV Au ions were found to show more D-isotope retention in comparison with 10 MeV boron ions. The range of both the ions were similar. For an order of magnitude higher fluence of boron (1.0 x 1019 ions-m-2), the trapped deuterium content was considerably lower than that of Au. The defect density observed Au irradiated sample was several orders of magnitude higher than the B irradiated ones. A similar observation was also confirmed using low temperature resistivity measurements.
In MD simulations, we see that at large energies of the Primary Knock-on Atom (>160 keV) the fragmentation of the cascade occurs which may have a direct relation to the experiments of heavy ion irradiation at 80 MeV where we see prominently dense clustering of dislocations and vacancies. Interestingly 10 MeV boron damage seems to produce PKA spectrum somewhat similar to that of 14 MeV neutron which is distinctly different than the defects produced and consequently deuterium trapping from heavy ion irradiation. These results will be presented along with computer simulations and limits to extrapolation damage from surrogate to neutrons will be highlighted.

Country or International Organization

India

Paper Number

MPT/2-3

Primary author: Dr MAYA, Padivattathumana N. (ITER-India, Institute for Plasma Research, Bhat, Gandhinagar)

Co-authors: Dr TYAGI, Anil (ITER-India, Institute for Plasma Research); Dr LAKHANI, Archna (UGC-DAE Consortium for Scientific Research, Indore, MP); Dr ATTRI, Asha (ITER-India, IPR); Dr DAVID, C (Indira Gandhi Center for Atomic Research, Kalpakkam, TN); Dr DEVI, Devrani (Inter University Accelerator Center, New Delhi, India); Dr KHAN, K B (Bhabha Atomic Research Center, Trombay, Mumbai); Mr SARAVANAN, K (Indira Gandhi Center for Atomic Research, Kalpakkam, TN, India); Mr MAL, Kedar (Inter University Accelerator Center, New Delhi, India); Mr SINGH, Manish (Bhabha Atomic Research Centre, Trombay, Mumbai); Dr WARRIER, Manoj (Bhabha Atomic Research Centre, Vishakhapatanam, AP, India); Mr ABHANGI, Mitul (Institute for Plasma Research, Bhat, Gandhinagar); Dr NANDI, P (ITER-India, Institute for Plasma Research, Bhat, Gandhinagar, India); Dr SUBHASH, P.V (ITER-India, Institute for Plasma Research, Gandhinagar, Gujarat); Prof. BAJPAI, PK (Guru Ghasidas VishwaVidyalaya, Koni, Bilaspur); Dr KULRIYA, PK (Inter-University Accelerator Center, New Delhi, India); Dr PUJARI, PK (Bhabha Atomic Research Centre, Trombay, Mumbai, India); Dr RAOLE, Prakash

(ITER-India, Institute for Plasma Research, Bhat, Gandhinagar, India); Dr SHARMA, Prashant (ITER-India, IPR Gandhinagar); Dr RAYJADA, Pratipalsinh A. (Institute for Plasma Research); Ms DAVE, Purvi (Institute for Plasma Research, Bhat, Gandhinagar, India); Mr KUMAR, Ratnesh (Institute for Plasma Research, Bhat, Gandhinagar); Dr KANNAN, S (Bhabha Atomic Research Center, Trombay, Mumbai); Dr MUKHERJEE, S (Bhabha Atomic Research Center, Trombay, Mumbai); Dr PATEL, SP (Guru Ghasidas Vishwavidyalay, Koni, Bilaspur); Mr VALA, SUDHIRSINH (INSTIUTE FOR PLASMA RESEARCH); Dr KHIRWADKAR, Samir (Institute for Plasma Research, Bhat, Gandhinagar, India); Mr AKKIREDDY, Satyaprasad (Institute for Plasma Research); Prof. DESHPANDE, Shishir (Institute for Plasma Research, Bhat, Gandhinagar, India); Mr MISHRA, Sudhir (Bhabha Atomic Research Center, Trombay, Mumbai); Dr TRIVEDI, T (Guru Ghasidas Vishwavidyalaya, Koni, Bilaspur, India); Mr KARKI, V (Bhabha Atomic Research Center, Trombay, Mumbai)

Presenter: Dr MAYA, Padivattathumana N. (ITER-India, Institute for Plasma Research, Bhat, Gandhinagar)

Session Classification: MPT/2, FNS/1, SEE/2 Materials, Fusion Nuclear Science, Environmental

Track Classification: MPT - Materials Physics and Technology