Review of Structural and Ceramic Materials under Irradiation in Inertial Fusion Reactors: comparison of Multiscale Modeling and Experiment

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Long term research on Reduced Activation Ferritic Alloys (RAFM steels) is being pursued in Fusion Programs, and an efficient lifetime is actually envisioned that will be here compared with that estimated in IFE reactor. However, from our simulations, comprehension of basic mechanisms of radiation damage is not understood to obtain predictive consequences. Multiscale simulation at the microscopic level will be compared with experiments, and results on the simplest material representing steels (Fe) will be reported as a function of impurity contents, temperature and dose. In addition, results using Molecular Dynamics allow us to identify stress-strain curve of FeCr ferritic steels under irradiation, and macroscopic conclusions can be advanced using simple models.

Radiation damage in amorphous ceramic Silica results in point defects that can lead to obscuration; that is, degradation of the optical properties of these materials. Atomistic threshold displacement energies of the components have been calculated using Molecular Dynamics, and cascade analysis for recoils of energies larger than 5 keV will be presented for working temperatures.

Research on radiation damage in SiC composite is being pursued at macroscopic level. However, results from theory and simulation to explain that physics is being slowly progressing. The systematic identification of the type of stable defects is the first task to perform, that will presented after verification of new tight binding techniques reported in the past. The different level of knowledge between simulation and experiments will be remarked.