

## Moving from DPA to Changes in Material Properties

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Atomic displacements by high energy particles in a crystalline solid induce formation of a large population of point defects and defect clusters of vacancies and interstitial atoms. The damaged microstructure results in significant changes in materials' physical and mechanical properties. Besides displacement damage, nuclear transmutation reactions produce He and H gas atoms that can have profound effects on materials performance even at low concentrations. Radiation effects in materials have been studied using various irradiation sources, e.g. fission, fusion and spallation neutron sources, high-energy ions and electron beams, etc. With different types of bombarding particles, radiation damage correlation is essential so that radiation effects produced by different irradiation sources can be compared and data can be transferred or extrapolated. The parameter commonly used to correlate displacement damage is the total number of displacements per atom (dpa). Irradiation-induced changes of material properties are measured as a function of dpa. Considering that a number of aspects of radiation exposure can give rise to property changes, the extent of radiation damage cannot be fully characterized by a single parameter. This paper will discuss damage correlation under various irradiation environments, key irradiation parameters and their effects on irradiation-induced property changes. It will also discuss the critical role of well-controlled *in situ* irradiation experiments and computer modeling in predicting damage to a material in different radiation environments.