PREDICTING IRRADIATION INDUCED DAMAGE USING THE STOPPING AND RANGE OF IONS IN MATTER

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The Stopping and Range of Ions in Matter (SRIM) is a software package developed based on the binary collision approximation (BCA) method, which is a Monte Carlo approach designed to calculate deposition profiles in materials exposed to energetic ion beams. SRIM is used frequently in the calculations of electronic and nuclear stopping powers for energetic incident ion in target atoms as it moves through the target until coming into rest. The resulting displacement or vacancies production is usually used to estimate the local damage dose in displacement per atoms (dpa), and to assess the irradiation effects caused by energetic charged particles in terms of structure and modifications of target composition and surface topography. SRIM offers two approaches to estimate ion induced damage in a target. The quick calculation of damage (K-P) mode which represents a quick statistical estimate based on the Kinchin-Pease “K-P” formalism, and it follows only the path of incidence ions; and the full-cascade detailed damage calculation option. While ion irradiation represents an essential substitute for the high dose neutron irradiation, there has been though some discussions and concerns regarding some observed discrepancies in the number of atomic displacements per ion produced by the two different calculation options provided by SRIM. In this study, different ions with different energies were used to calculate the displacement damage in targets using SRIM provide different damage calculation options, to study and quantify the discrepancies that would arise in each case; this will contribute in the assessment and the better understanding of such discrepancies.