HELIUM VS. PROTON INDUCED DISPLACEMENT DAMAGE IN ELECTRONIC MATERIALS

Background Information

•Anomalous Cosmic Rays (ACRs) are a distinct group of charged and energetic particles in space that, like all other ionizing radiation in space (for example, Galactic Cosmic Rays or GCRs and Solar Energetic Particles or SEPs) that can affect electronic materials. Since protons outnumber other ions in GCR, typically only displacement damage due to them is considered in simulation and modeling of radiation effects in electronic materials. However, it is now known observationally that the intensity of ACR helium can exceed that of protons under some conditions. Hence, displacement damage due to the passage of ACR helium in electronic materials needs to be characterized on par with that due to GCR protons or ACR protons

Abstract

•In this project, the specific effects of displacement damage due to the passage of protons and helium nuclei on some typical electronic materials will be evaluated and contrasted. As the electronic material absorbs the energetic proton and helium momentum, degradation of performance occurs, eventually leading to overall failure. Helium nuclei traveling at the same speed as protons are expected to impart more to the material displacement damage; due to the larger mass, and thus momentum, of helium nuclei compared to protons. Damage due to displacement of atoms in their crystalline structure can change the physical properties and hence performance of the electronic materials.

Tool

•The well-known SRIM, the Stopping and Range of Ion in Matter is a suite of computer codes that establishes methods for determining the stopping and range of ions. Based on accurate experiments and theoretical concepts, it calculates ion stopping and range in targets, ion implantation, sputtering, ion transmission, and ion beam therapy.

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