Abstract Book

2nd International Conference on Recent Trends in Applied Physics & Material Science

RAM 2024

Second International Conference on Recent Trends in Applied Physics & Material Science

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Role of projectile ion mass in vacancy formation on muscovite mica

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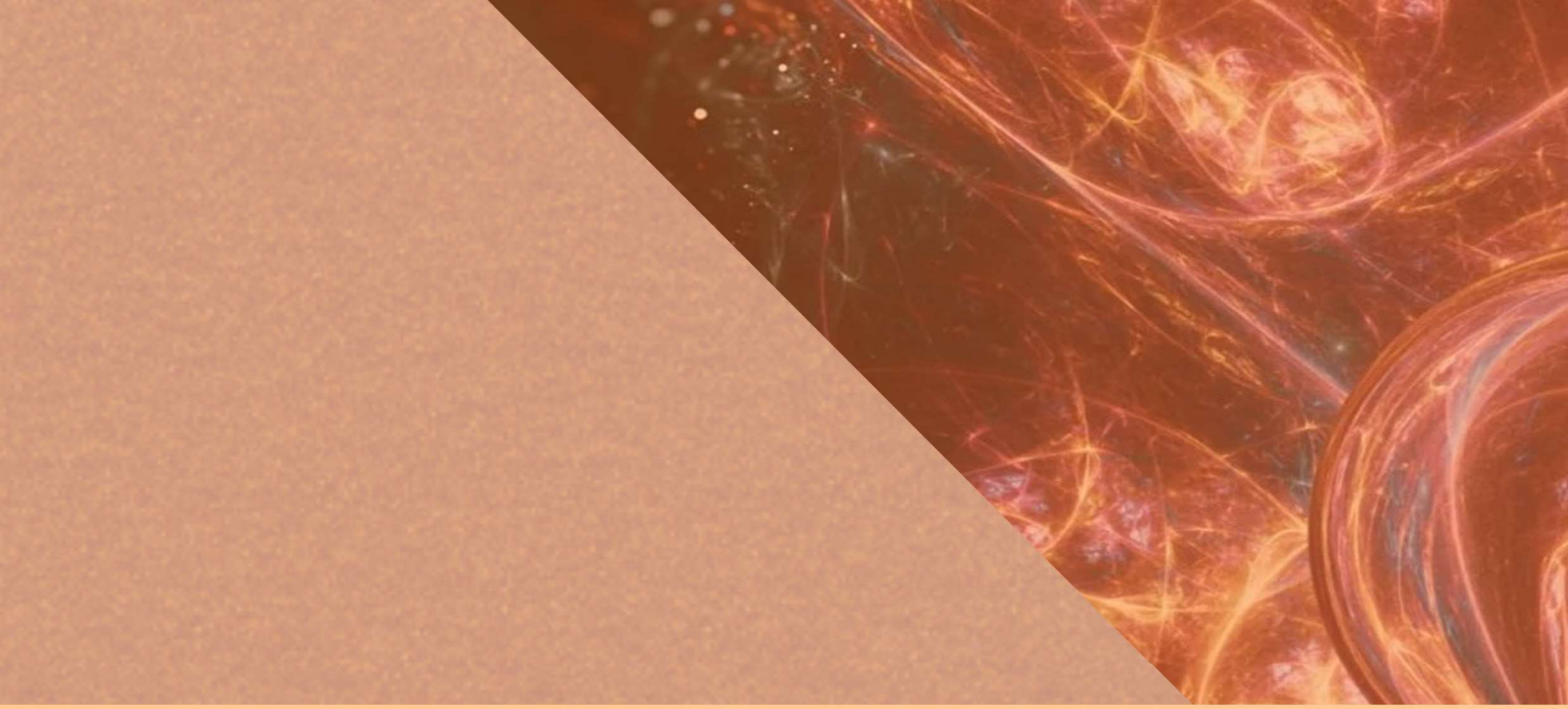
Abstract

Muscovite mica [$KAl_2(Si_3Al)O_{10}(OH)_2$] is a layered, multi-elemental, electrically insulating material with an atomically flat surface. Due to such unique properties, mica is applicable for different applications. The introduction of defects can tailor the properties of mica drastically. This study explores the impact of projectile ion mass on defect and vacancy formation in muscovite mica using Monte Carlo simulation. Low-energy irradiation (10 keV) with Ar^+ and O^+ ions at normal and near-grazing incidence is considered. Results show varying vacancy formation in mica's constituent elements, with heavier Ar-ions inducing maximum vacancy production. Despite similar total energy transfer, damage, and vacancy production differ across ions. A shift in the ion distribution profile towards deeper penetration depths is observed. SRIM simulations based on the NRT displacement model provide a qualitative explanation for vacancy formation, considering the energetic ion's energy transfer. The study sheds light on the interplay between projectile mass, energy transfer, and vacancy formation in muscovite mica. Ar^+ ions, being heavier, exhibit greater damage due to higher transferred energy, leading to increased vacancy formation. The displacement energy for oxygen atoms is larger, resulting in higher oxygen vacancy in muscovite mica compared to other elements. The available energy for creating damage (T_{dam}) is greater for Ar^+ ion bombardment compared to other ions. This leads to more vacancy formation compared to other ions.



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