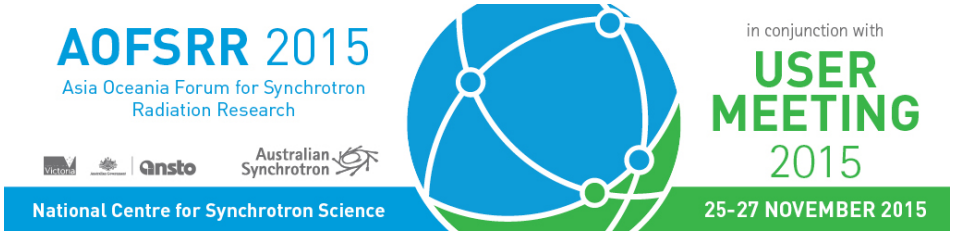

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Study of swift heavy-ion irradiation of amorphous silicon oxynitride films

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In this work we present direct evidence of ion track formation in 1-micron-thick silicon oxynitride films deposited by Plasma Enhanced CVD (PECVD) after irradiation with 185 MeV Au ions at different fluences. Silicon oxynitrides are gradient refractive index materials (GRIN), where its physical properties are linear combination of Si_3N_4 and SiO_2. The morphology of the ion tracks were studied by means of Small Angle X-ray Scattering (SAXS) while the structural damage was analysed by Fourier Transform Infrared Spectroscopy (FTIR). Swelling or compaction as a result of high fluence irradiation was studied using Atomic Force Microscopy (AFM). A quantitative comparison with Si_3N_4 deposited by Low Pressure CVD (LPCVD) and a-SiO_2 is provided.

SAXS measurements of samples irradiated at low fluences average a large number of single tracks providing reliable results about the morphology. Continuous tracks with a core-shell structure were found, a small core (less than 2 nm) surrounded by a thick shell (4-6 nm), presumably with an underdense core and an overdense shell, similar to the results found in a-SiO_2. Only slight differences were found for ion tracks in LPCVD Si_3N_4.

Analysis from FTIR measurements yields an ion track radius of 1.8 nm, which closely matches the core size. This is an indication that in amorphous materials most of the radiation damage is produced in the core region.

Keywords

swift heavy-ion, silicon oxynitrides, SAXS

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