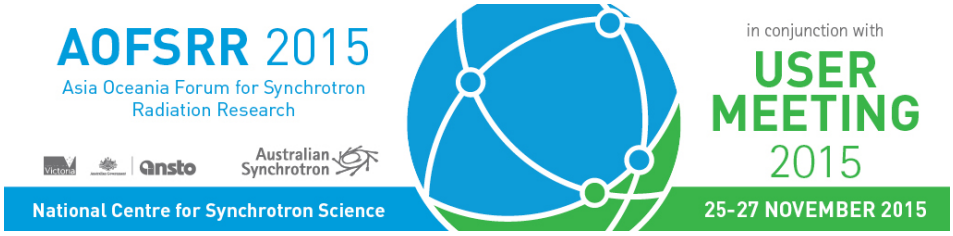

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Characterisation of Ion Tracks using Small Angle Scattering

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Ion tracks are narrow trails of permanent damage generated along the paths of highly energetic heavy ions. These tracks are generally between 5-10 nm in diameter and can be tens of micrometers long. They have applications in many disciplines including materials science and engineering, nuclear physics, geochronology, archaeology, and interplanetary science.

If generated in an accelerator, an ensemble of ion tracks comprises parallel, (almost) identical nano-sized objects with negligible overlap. Due to their high monodispersity, small angle scattering, albeit measuring typically ~10^7 ion tracks, can yield information about the individual track structure averaging out fluctuations on an atomic level. Parallel alignment and stochastic distribution of the tracks reduces the analysis to simple form-factor scattering, yet due to their high aspect the 'small angle approximation' is no longer valid.

Over the last years we have demonstrated that SAS can resolve details of ion tracks in many materials inaccessible to other techniques [e.g. see 1-3]. This includes implementation of innovative capabilities at the Australian Synchrotron SAXS/WAXS beamline, including the use of diamond anvil cells in combination with in situ annealing to study ion track recovery of minerals under high pressure. More recently we developed a Monte-Carlo code to calculate scattering from complex track morphologies.

This presentation will give an overview of our work on ion tracks highlighting the new capabilities we have developed.

1. Phys. Rev B **90** (2014) 224108
2. Phys. Rev. Lett. **101** (2008) 175503
3. Phys. Rev. Lett. **110** (2013) 245502

Keywords

ion tracks, SAXS, radiation damage, minerals, high-pressure, materials science

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