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Keywords: Titanium, phosphate, crystallography

MS18 Structures of minerals, planetary and carbon materials at Earth and planetary conditions

Chairs: Tiziana Boffa-Ballaran, Marco Merlini

MS18-P1 Solid-gas carbonation of amorphous silicates: the origin of cosmic carbonates?

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Silicates are the most abundant component of cosmic dust present in the universe, forming in the atmospheres of dying stars as primitive, structurally disordered grains. Throughout their lifetime dust grains are subjected to a number of physical processes leading to their evolution from highly disordered, refractory grains to the more complex crystalline mineral species that were present within the solar nebula. Of particular interest is the formation of crystalline Ca-rich carbonate minerals that have been identified in the spectra of evolved stars, protoplanetary disks and planetary nebulae [1]. Due to the absence of liquid water in these environments and that direct condensation of carbonates is unlikely, due their low condensation temperature [2] it is believed that carbonate species in such environments could form through solid-phase alteration of amorphous Ca-bearing silicates with gaseous CO_2.

Amorphous cosmic silicate analogues are produced using a well-developed sol gel technique [3] in which the gels are dried under high-vacuum (~10^{-6} mbar) to produce highly disordered, fine-grained powders of composition $Mg_{(x)}Ca_{(1-x)}SiO_3$, where $0 \leq x \leq 1$, analogous to the primitive silicates present within circumstellar and interstellar mediums [4]. Beamlines I11 and I12 at Diamond Light Source have been used to conduct synchrotron X-ray powder diffraction (SXPD) and Pair Distribution Function (PDF) measurements respectively, both in-situ and ex-situ. These measurements together provide an insight into the underlying structural mechanics that govern the carbonation reaction at the amorphous level as well as allowing a detailed study of the reaction kinetics and phase evolution.

The results of this research will be presented, focusing on the structural mechanisms involved with the carbonation of silicates in order to place constraints on the environmental conditions and initial silicate compositions favourable for carbonate formation.

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Keywords: amorphous silicates, carbonates, powder diffraction, PDF

MS18-P2 Single Crystal High Pressure Diffraction at the Advanced Light Source

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Beamline 12.2.2 at the Advanced Light Source, which was previously optimized for high pressure powder diffraction only, has undergone the substantial addition of a dedicated single crystal diffractometer. Positioned upstream of the existing endstation, the new endstation consists of a Stoe Stadi Vari diffractometer equipped with a RDI CMOS detector. The system was configured with high pressure diffraction in mind: a small sphere of confusion(10μm), a sample weight capacity compatible with DACs (1kg), and a detector phosphor optimized for 25keV. System details and commissioning experiment results will be shared.

Keywords: high pressure, single crystal