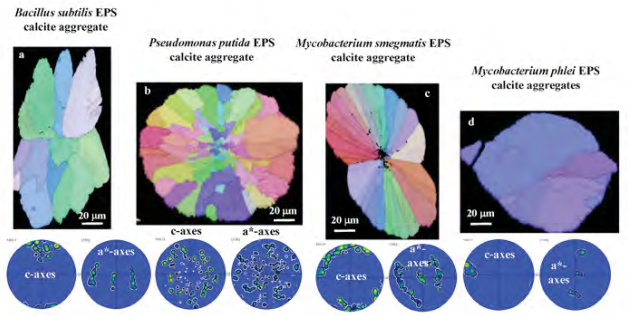
sent; aggregate and calcite crystal morphologies and surfaces are always rounded. The aggregates are radial mosaic crystals, with their individual subunits not being substructured (Fig. 1). Calcite crystal co-orientation strength and patterns range from markedly co-oriented (Fig. 1d) over graded (Figs. 1c, 1a), to very little co-oriented (Fig.1b). Hence, EPS incorporation within the calcite modulates the mineral microstructure and texture in a manner that is characteristic for the EPS of a specific bacterium. These characteristics could be used as a tool for identifying biologically induced calcification in the geological record[3].



References:

[1] Ronholm, J. et al. (2014). Geobiology 12, 542-556.
[2] Checa, A. G. et al. (2016). P. R. Soc. B 283, 20160032.
[3] Päßler, J.-F. et al. (2018). Front. Earth Sci. 6, Article 16.

Keywords: bacteria EPS, mineral organization, EBSD, biomarker

MS17-O5

Crystallographic characterisation of fluorapatite based glass-ceramics synthesised from industrial waste

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Apatite based glass-ceramics have been extensively studied in recent decades. They show excellent mechanical properties, bioactivity and compatibility for biomedical applications. They can form an apatite layer and strong chemical bonds at the bone or tooth interface with the implant [1]. The nano-crystalline structures, bioactivity and mechanical strengths of such glass-ceramics depend on their parent glass composition and the crystallisation processes during sintering.

A series of phase transformations of novel calcium fluoraluminosilicate (CFAS; SiO_2-Al_2O_3-P_2O_5-CaO-CaF_2) glasses forming a range of fluorapatite based glass-ceramics on sintering are reported. The sintering process induces formation of fluorapatite, mullite and anorthite phases within the amorphous silicate matrices of the glass-ceramics. The glasses are partially prepared from waste materials such as rice husk ash, pacific oyster shells and disposable aluminium cans. The thermally induced crystallographic and microstructure evolution of these glasses towards fluorapatite glass-ceramics, with applications in dental and bone restoration, are investigated by a range of techniques, including powder X-ray diffraction as well as small angle X-ray and neutron scattering techniques [2].

The observed phase transformations of glasses to glass-ceramics for the investigated compositions enhance our understanding of the effects of glass composition and sintering temperatures on the phase transitions in glass-ceramics. All investigated glasses produce fluorapatite glass-ceramics on sintering at temperature around 800 °C. The optimum glass compositions and sintering temperatures to produce fluorapatite-mullite, fluorapatite-anorthite and fluorapatite-albite glass-ceramics have been identified from PXRD analysis and will be presented. Formation of fluorapatite in glass-ceramics can also be identified from the far-infrared spectrum in agreement with the PXRD results. The fluorapatite glass-ceramics contain crystalline fluorapatite domains dispersed in an aluminosilicate glass matrix. This can be verified from FESEM imaging and the analysis of SANS data. The SANS results provide information about the average size of the fluorapatite domains in glass-ceramics. SANS data were interpreted using the correlation length model. The correlation length parameter obtained from the fit can be correlated with the average sizes of crystalline domains in these glass-ceramics.

The suitability of the investigated CFAS glasses to produce glass ionomer cements for dental restoration has been assessed and found to be comparable to the standard LG26 glass, thereby demonstrating the feasibility of using waste materials to develop biomaterials for bone and dental restoration.

References:

[1] Denry, I. & Holloway, J. A. (2014). "Low temperature sintering of fluorapatite glass-ceramics," Dental Materials, 30(2), 112-121.
[2] Hill, R. & Calver, A. (2007). "Real-time nucleation and crystallization studies of fluorapatite glass-ceramics using small-angle neutron scattering and neutron diffraction," Journal of the American Ceramics Society, 90(3), 763-768.

Keywords: glass-ceramics, small-angle scattering, fluorapatite

MS18 Crystallography at high pressure and dynamically compressed matter

Chairs: Dr. Damian Paliwoda, Dr. Ines Collings

MS18-O1

X-Ray diffraction studies of mineral phase transitions under shock compression

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Laboratory shock wave experiments have long played an important role in the study of geological materials under extreme pressure and temperature conditions. Shock compression experiments provide the unique capability to study impact phenomena in real time and allow for measurements of equations of state and phase transitions. However, a limitation of continuum shock wave studies is that the crystal structure of high-pressure phases formed under dynamic compression is generally not known. This talk will focus on new experiments carried out at the Dynamic Compression Sector (DCS) of the Advanced Photon Source. DCS couples gun-based dynamic compression platforms with time-resolved synchrotron X-ray diffraction. This allows for an *in situ* study the crystal structure of minerals shocked into the high pressure and high temperature conditions that occur in the Earth's interior or during meteorite impacts. The diffraction data are combined with continuum-level measurements to reveal a complete picture of the material response from the atomic length scale to the continuum level, allowing for the unambiguous determination of the phase(s) formed under shock compression at ~100 ns timescales. This talk will review recent experiments carried out at DCS on materials including SiO_2, TiO_2 and ZnO. The resulting diffraction patterns are used to identify the high-pressure mineral structures and texture analysis of data for shocked single crystals can provide insight into transformation pathways between low- and high-pressure phases. The findings improve our understanding of minerals in the Earth's deep interior and allow us to better understand crystal structure modifications that occur in shocked minerals during meteorite impact events.

Keywords: shock, Hugoniot