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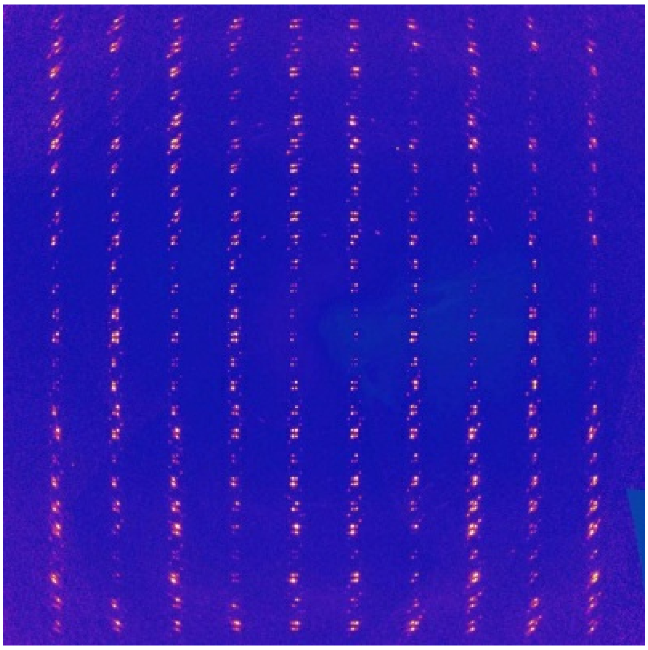
Dynamic studies of incommensurate materials

Sven Lidin[1], Laura Folkers[1]
[1]*Lund University Dept. Chemistry, Lund, Sweden*
E-mail: sven.lidin@chem.lu.se

Incommensurate structures often appear as intermediate phases between disordered high temperature phases and commensurate low temperature phases. The high flux of synchrotron sources allows the study of the phase transformations involved and in particular, diffusion-less transformations may be studied in some detail.
The innocuous-looking compound AuIn(1) undergoes a series of transformation from room temperature to the melting point. At room temperature the structure is incommensurately modulated with up to 4th order satellites visible. As the temperature is increased, the modulation vector changes slightly and the number of satellites gradually decreases to 1st order only and then become smeared out into diffuse scattering. All this is manifest only as a broad hump in a DTA measurement. The diffuse scattering abruptly disappears at 713K and the structure reverts to a simple commensurate structure. A section of the room temperature diffraction pattern from AuIn (below) clearly shows 1st and 3rd order satellites
Stistaite is an old friend that we have revisited before(2). The Sn-Sb phase diagram contains a wide solid solution compound, stistaite, that exists from just shy of 40% Sn to 57% Sn. This is an incommensurate structure with rhombohedral symmetry. At a slightly higher Sn content, the phase Sn_3Sb_2 is closely related to stistaite, but unstable at low temperature. Quenching single crystals of Sn_3Sb_2 results in a complex object consisting of mimetically twinned stistaite and tin with seemly cubic symmetry but where four different orientations of stistaite and three different orientations of tin contribute to the diffraction pattern. In an experiment where rhombohedral stistaite was heated together with an excess of tin we were able to record the diffraction pattern of ht-Sn_3Sb_2 and solve the structure.
Both experiments were conducted at the Soleil synchrotron in Paris and much thank is due to Pierre Fertey who provided excellent technical support.
1) Schubert, K., Breimer, H. & Gohle, R., Z. Metallkunde, 50, 146-153, 1959
2) Lidin S, Christensen J, Jansson K, Fredrickson D, Withers R, Norén & L, Schmid S.Inorg Chem. 48, 497-503, 2009



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