Oral Contributions

[MS15] Electron microscopy for aperiodic structures

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[MS15-01] Modulated Structures and Microscopes: from doped Bismuth Ferrites to Nano-Chessboards,

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Many crystalline materials are inflexible -locked into fixed compositions, conventional 3-D space group symmetries and in unique dominant free energy minima. However, by no means all materials fit into such neat pigeon holes! A by now quite large and ever-increasing class of materials have been shown to be 'modulated' in one form or another. The modulations can be short or long range ordered, of large or small amplitude while the associated occupational, displacive, magnetic, ... Atomic Modulation Functions (AMF's) required for their complete structural characterization in superspace can be essentially sinusoidal, inherently square wave or saw tooth in form. Whatever the particulars, an understanding of the local crystal chemistry underlying the existence of such phases as well as their associated physico-chemical properties can not be had until their true modulated structures are known. The Transmission Electron Microscope (TEM) is an extremely well-adapted instrument for the initial detection of such modulated structures as well as for their symmetry and structural characterization as a result of the sensitivity of electron diffraction to weak subtle features of reciprocal space, the ability to obtain such information from small local regions as well as the capacity to image in various modes with excellent spatial resolution and over a considerable range of temperature. In this contribution, the practical application of electron microscopy to the structural characterization of modulated structures ranging from doped bismuth ferrites [1], through (3+3)-D cubic oxide ion conductors [2] to the $Li_{3x}Ln_{2/3-x}TiO_3$, $0.047 < x < 0.147$, nano-chessboard phase will be illustrated.

[1] J.Schiemer, R.Withers, L. Noren, Y.Liu, L.Bourgeois and G.Stewart, *Chemistry of Materials* 2009, **21**, 4223-4232.
[2] C.D.Ling, S.Schmid, P.E.R.Blanchard, V.Petricek, G.J.McIntyre, N.Sharma, A.Maljuk, A.A.Yaramchenko, V.V.Kharton, M.Gutmann and R.L.Withers, *Journal of the American Chemical Society* 2013, **115**, 6477-6484.
[3] R.L.Withers, L.Bourgeois, A.Snashall, Y.Liu, L.Noren, C.Dwyer and J.Etheridge, *Chemistry of Materials* 2013, **25**, 190-201.

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