Structural Characterisation of Ceramics using a Direct Electron Detector in the Scanning Transmission Electron Microscope

Author(s): T.A. Macgregor, I. MacLaren
Institution(s): University of Glasgow
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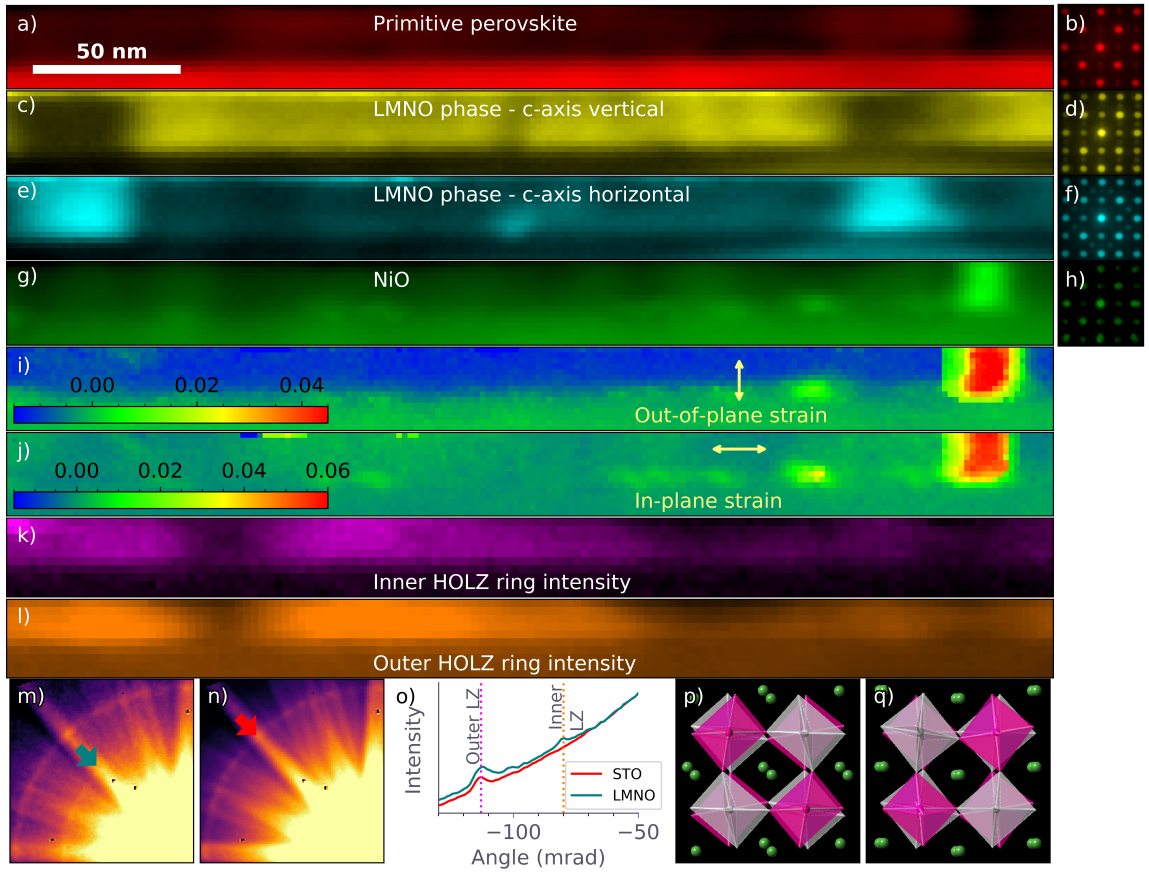
Abstract

This research reports the observation of HOLZ rings in thin films of the functional ceramic La_2NiMnO_3 (LMNO).
A direct electron detector (DED) in an electron microscope was used to record diffraction patterns on a per pixel basis, this means the structural differences between the substrate and the film can be quantified.

Project Description

By extracting diffraction patterns (b,d,f,h), for all the phases in the specimen, These include two domains in the LMNO, the substrate and a NiO inclusion to be mapped (a,c,e,g) These patterns can be used to measure in and out of the plane strain within LMNO (i,j); this confirms that there is out of plane compressive stress as shown in i) and j).
The Laue Zone maps and profiles (m-o) show unit cell doubling, i.e. two rings ,in the LMNO (red and green arrows). . This evidence for the periodic ordering of the Mn and Ni atoms within the LMNO.

Diffraction Pattern Analysis



Summary

- DED data can be acquired quickly (~10 min)
- Complementary to XRD and other measurements
- Will be used to measure a variety of other materials in future work

References: Nord, M. *et al.*. *Physical Review Materials* **3**, 063605 (2019). Paterson, G., Webster, R., Nord, M., Paton, K. & Doye, A. FPD: Fast pixelated detector data storage, analysis and visualisation. (2019).de la Peña, F. *et al.* Hyperspy Software Package. (2019). doi:10.5281/zenodo.583693Eggeman, A. S., Krakow, R. & Midgley, P. A. Scanning precession electron tomography for three-dimensional nanoscale orientation imaging and crystallographic analysis. *Nature Communications* **6**, 1–7 (2015).