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MS-5-O-3068 DETERMINATION OF STRUCTURE AND CHEMISTRY OF LONG-PERSISTENCE STRONTIUM ALUMINATE PHOSPHOR COMPOUNDS IN ABERRATION-CORRECTED TEM/STEM

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Representing a source of short-term stored energy, strontium aluminate phosphor compounds of nominal stoichiometry $(SrO)\bullet(Al_2O_3)_2$ co-doped with 1 mol% Eu^{2+} and 1 mol% Dy^{3+} (SA_2ED) exhibit long persistence that is even further extended by the incorporation of boron[1]. To elucidate the effect of boron on afterglow persistence, we synthesized the phosphor powders using a sol-gel (i.e., modified Pechini) method[2] and investigated the chemistry and structure by applying high-resolution STEM imaging, energy dispersive X-ray (EDX) spectroscopy, and electron energy-loss spectroscopy (EELS). Large single-crystal grains were analyzed from as-reduced powders suspended on carbon-coated lacey formvar on copper support grids. Individual crystalline particles were tilted onto a low-index [0001] zone axis and imaged in both high resolution TEM and STEM, using a JEOL JEM-ARM 200CF, equipped with a cold field emission tip and a probe-side C_s aberration corrector. High-angle annular dark-field (HAADF) images were formed using an annular detector with an inner diameter of 70 mrad and an outer diameter of 175 mrad, while annular bright-field (ABF) images were obtained from an annular detector of 11-mrad inner diameter and 23-mrad outer diameter. EDX spectra were collected using a JEOL Centurio Dry SD100GV SDD detector. EELS analysis was enabled by a Gatan GIF Quantum ER spectrometer.

Rietveld refinement of XRD spectra obtained from the powders revealed a mixture of $(SrO)_4\bullet(Al_2O_3)_7$, $(SrO)\bullet(Al_2O_3)_2$, and $(SrO)\bullet(Al_2O_3)_6$ phases. Single crystal particles of the $(SrO)\bullet(Al_2O_3)_6$ phase were the most stable and allowed for tilting onto the [0001] zone axis for qualitative identification of the atomic columns in HAADF and ABF micrographs. Quantitative image simulations of the measured intensities are in progress. Local variations were observed in the energy loss near-edge fine structure of the B-*K*, O-*K*, Al-$L_{2,3}$ edges.

References

1. A.V. Uluc, Sabanci University, M.Sc. Thesis, 2008.

2. M.G. Eskin, Sabanci University, M.Sc. Thesis, 2011.

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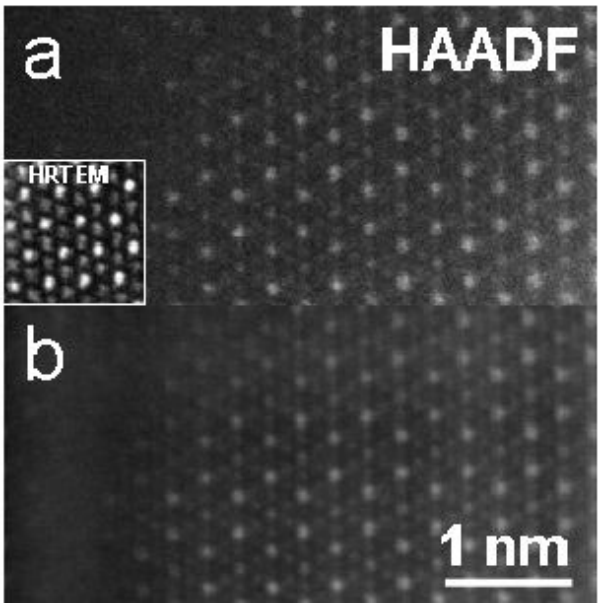

Fig. 1: High-resolution HAADF STEM micrographs of a $SrO•(Al_2O_3)_6$ crystal tilted onto the [0001] zone axis. (a) Experimental image, (b) noise filtered image. Inset: HRTEM.

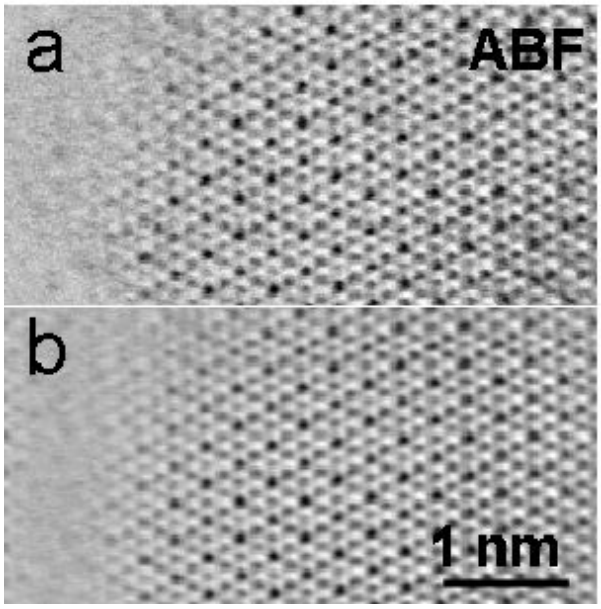

Fig. 2: High-resolution ABF STEM micrographs of a $SrO•(Al_2O_3)_6$ crystal tilted onto the [0001] zone axis. (a) Experimental image, (b) noise filtered image.

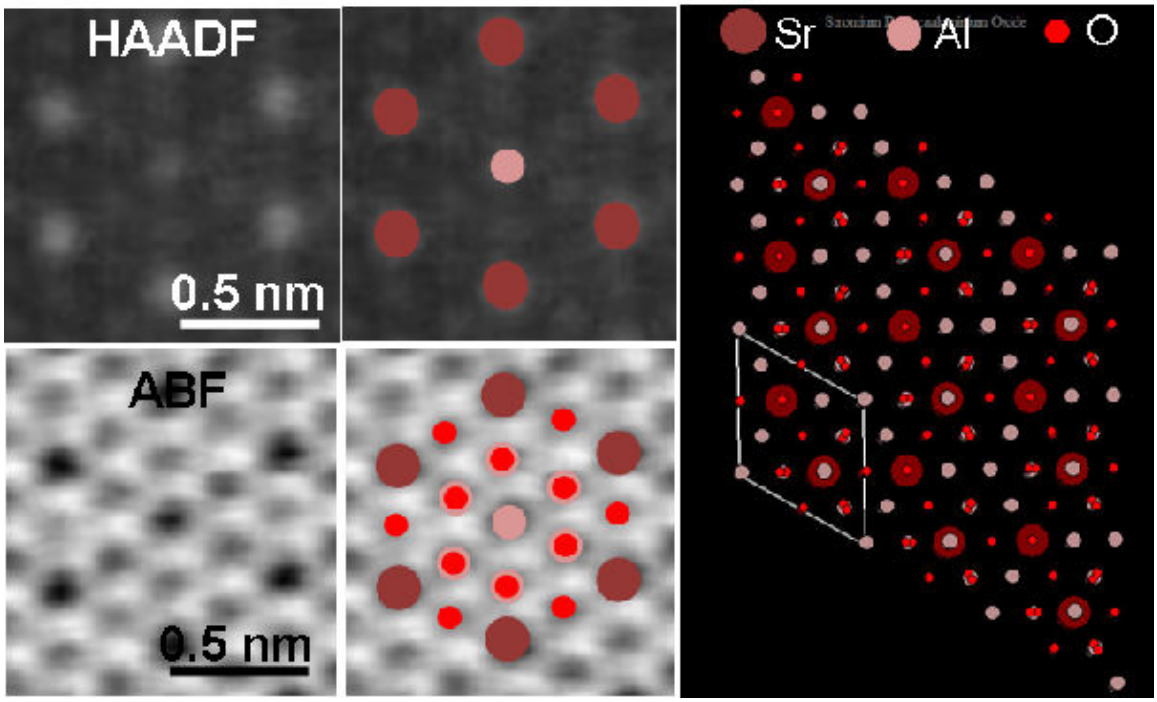

Fig. 3: The positions of the oxygen atomic columns in the ABF micrograph are clearly resolved in the $SrO•(Al_2O_3)_6$ crystal matrix, as viewed along the [0001] zone axis.