Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Spatially-Resolved X-Ray Microstructural Studies of Bulk Phase Separation in Manganites[1] J.D. BUDAI, Oak Ridge National Lab, D.D. SARMA, Ind. Inst. of Sci., W. LIU, ANL, J.Z. TISCHLER, B.C. LARSON, ORNL, G. SHENOY, ANL, D. TOPWAL, Ind. Inst. of Sci., S-W. CHEONG, Rutgers Univ. — We have used spatially-resolved, 3D x-ray microdiffraction to study phase separation in two directionally-solidified, transition-metal oxide systems: (Y,Eu)MnO and (Lu,LaSr)MnO. Both systems exhibit micron-scale coexistence of separate single-crystal lamellar domains (hex/ortho and hex/rhomb respectively) when grown by a floating zone method. Micron-resolution 3D x-ray microscopy reveals the domain morphologies, lattice orientations, and local strain fields within the phase-separated eutectic systems. The orientations of the lamellae are consistent with energetic predictions and the formation of low-energy, semi-coherent interfaces. In addition, we observe a bias for larger strain fluctuations in one phase. More generally, the microstructural features observed experimentally in these well-defined, micron-scale eutectic domains provide clues to the domain interactions believed to exist in similar, more homogeneous, nanoscale manganite systems. Structural studies at the nanoscale will be enabled in the future by advances in x-ray focusing optics.

[1]Support by DOE Office of Basic Energy Sciences, Div. of Materials Sciences & Engineering; XOR-UNI and APS supported by DOE-BES.

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Date submitted: 02 Dec 2007 Electronic form version 1.4