Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Atomic Resolution Strain Analysis of Oxide Superlattices JI-HWAN KWON, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, JASON HOFFMAN, ANAND BHATTACHARYA, Materials Science Division, Argonne National Laboratory, JIAN-MIN ZUO, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign — Measuring strain inside the heteroepitaxial transition metal oxide superlattices is critically important, as strain controlled by composition has a large impact on the superlattice properties. Because of the small periods in oxide superlattices, strain analysis must be performed at atomic resolution in order to examine, for example, how strain changes across the interface, whether strain is uniform inside oxide layers or it varies from intermixing between the constituent materials. Strain analysis also provides structural information of the heteroepitaxial superlattice. In this study, we examined the strain in $LaNiO_3$(LNO)/$LaMnO_3$(LMO) superlattice thin films grown on $SrTiO_3$ substrate with a spatial resolution of a single perovskite unit cell using template matching method based on the Z-contrast image. The LNO/LMO interface is hard to be determined by Z-contrast imaging alone due to the same element occupation for A-site and the similar atomic number Z for B-site (Mn and Ni). However, strain analysis reveal sharp interfaces between LNO and LMO layer, in which LNO layers are subjected to tensile strain while LMO layers to compressive strain, showing alternating epitaxial strain inside the superlattice. The detailed analysis including strain variation depends on number of LNO layer and associated deviation of B-site position will be presented.

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Date submitted: 15 Nov 2013 Electronic form version 1.4