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High Resolution X-ray Diffraction Analysis of Residual Stresses in Epitaxial Thin Films of Rare Earth Manganite Thin Films on Silicon[1]

GRACE YONG, KEVIN TANYI, PRAKASH SHARMA, ZOEY WARECKI, RAJESWARI KOLAGANI, Towson University, MADHANA SUNDER, Bruker AXS Inc — Epitaxial integration of complex metal oxides on thin films on Si, which is needed for realizing device functionalities, offers challenges on account of several factors such as reactivity of oxide materials with Si at the high temperatures needed for epitaxial growth, the presence/formation of the amorphous native oxide layer, and the thermal expansion mismatch of Si with that of the oxides which leads to the accumulation of stresses during thermal cycling of the film. In order to achieve epitaxial growth circumventing these problems, lattice engineering schemes employing heterostructures of appropriate chemical buffers and structural-templates must be adopted. The film growth parameters and thermal cycling kinetics play a key role in determining the residual stresses in such heterostructures. It is important to monitor the stresses as a function of growth parameters and optimize the parameters to minimize the stresses. We will present our studies of the residual stresses in epitaxial thin films of hole doped rare earth manganite thin films grown on Si using high resolution four-circle x-ray diffraction.

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