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Time-resolved X-ray diffraction and heat propagation on LSMO/STO superlattices

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We report on the first time-resolved X-ray diffraction experiment at the EDR beamline at BESSY II performed on epitaxial La0.8Sr0.2MnO3 (LSMO) and SrTiO3 (STO) superlattices grown on single crystal STO substrate. A Ti:Sapphire laser operating at 208 kHz frequency with 350 fs pulse duration was used as a pump beam. The X-ray pulses from a bending magnet were monochromotized using a single Ge crystal and used as a probe. Superlattice diffraction peak profiles were recorded as a function of pump-probe delay. The measured peak shift, which is proportional to the strain in the superlattice, is a measure of the thermal expansion. Heat transport in both the superlattice and the substrate has been studied on timescales of 50 ps to 4 μs. The experimental results agree well with theoretical simulations of heat transport in such systems. The transient thermal expansion was determined with an accuracy of 10ˆ-7, which corresponds to a temperature rise of 0.01℃.

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