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Ultrafast structural dynamics of LaVO3 thin films grown by hybrid molecular beam epitaxy MATTHEW BRAHLEK, JASON LAPANO, VLADIMIR STOICA, LEI ZHANG, HAI-TIAN ZHANG, HIROFUMI AKAMATSU, CRAIG EATON, VENKATRAMAN GOPALAN, Pennsylvania State University, JOHN FREELAND, HAIDAN WEN, Argonne National Lab, ROMAN ENGEL-HERBERT, Pennsylvania State University — $LaVO_3$, with a partially full d-shell is expected to be metallic, but due to electron-electron interactions a gap emerges and the ground state is a Mott insulator. Such effects are a strong function of the bonding geometry, and particularly the V-O-V bond angle. Controlling these structural effects on the ultrafast time scale can lead to control over the underlying electronic ground state. Here we report the ultrafast structural dynamics of 25 and 50 nm thick $LaVO_3$ thin films grown by the hybrid molecular beam epitaxy technique on $SrTiO_3$ when excited across the bandgap by 800 nm light. Using time-resolved x-ray diffraction on the 100 ps time scale at Sector 7 of the Advanced Photon Source, we directly measured the structural changes with atomic accuracy by monitoring integer Bragg diffraction peaks and find a large out-of-plane strain of 0.18% upon optical excitation; the recovery time is ˜1 ns for the 25 nm film and ˜2 ns for the 50 nm film, consistent with the thermal transport from the film to the substrate. Further, we will discuss the response of the oxygen octahedral rotation patterns indicated by changes of the half-order diffraction peaks. Understanding such ultrafast structural deformation is important for optimizing optical excitations to create new metastable phases starting from a Mott insulator. This work was supported by the Department of Energy under Grant DE-SC0012375, and DE-AC02-06CH11357.

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