Abstract Submitted
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Optical control of structural evolution of ultrathin VO_2 film following a photoinduced metal-insulator phase transition[1] HAIDAN WEN, X-ray Science Division, Argonne National Laboratory, EFTIHIA BARNES, Department of Materials Science and Engineering, Pennsylvania State University, JUNE H. LEE, YUELIN LI, DONALD A. WALKO, ERIC M. DUFRESNE, X-ray Science Division, Argonne National Laboratory, MARTIN HOLT, Center for Nanoscale Materials, Argonne National Laboratory, DARRELL G. SCHLOM, Department of Materials Science and Engineering, Cornell University, VENKATRAMAN GOPALAN, Department of Materials Science and Engineering, Pennsylvania State University, JOHN W. FREELAND, X-ray Science Division, Argonne National Laboratory, — Using ultrafast x-ray diffraction technique, we have demonstrated that the structural symmetry in VO_2 thin film across the metal-insulator transition (MIT) can be controlled by the optical pump fluence. After an 800 nm, 50 fs laser excitation, the structural evolution of a 13nm-thick, MBE-grown VO_2 film on TiO_2 substrate was monitored by a synchrotron based x-ray diffraction with 100 picosecond (ps) time resolution. By adjusting the pump fluence, the VO_2 film can be prepared in selected structural state 100 ps after excitation, and transits through the known structural phases (tetragonal, monoclinic M2, monoclinic M1) in tens of nanoseconds time scale. When pumping at high fluence (28 mJ/cm^2), a new transient state that exhibits lower symmetry than the thermal equilibrium tetragonal phase has been identified and its evolution pathway has been measured.

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