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Photoinducing the hidden M2 phase in VO_2[1] D.A. WALKO, Argonne National Laboratory, R.K. SMITH[2], Bowling Green State University, HAIDAN WEN, A.D. DICHIARA, Argonne National Laboratory, JAEWOO JEONG, MAHENSH G. SAMANT, IBM Almaden Research Center, STUART S.P. PARKIN, IBM Almaden Research Center and Max Planck Institute for Microstructure Physics
— We used time-resolved x-ray diffraction to study photoinduced structural phase transitions in a 170-nm-thick VO_2 film grown on sapphire (1,0,-1,0). Heating the unstrained film from room temperature induces the well-known phase transition from the monoclinic (M1) phase directly to the high-temperature tetragonal rutile (R) phase. In contrast, upon ultrafast optical excitation, the phase transition depends strongly on the laser intensity. At low fluences, the film is partially transformed into the monoclinic M2 phase, a phase which generally is observed only in doped or strained materials. Above a threshold at higher fluences, a small portion of the film is transformed into the M2 phase, decaying on a time scale of a few nanoseconds, while the majority of the film is transformed into the R phase which can persist for tens of nanoseconds. We further discuss the effects of laser wavelength on the efficiency of producing the M2 phase.

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