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Pathways of Photoinduced Insulator-Metal Transition in VO2 and V3O5[1] SERGIY LYSENKO, Department of Physics, University of Puerto Rico, Mayaguez, Puerto Rico 00681, USA — Time-domain studies of ultrafast phase transition in vanadium oxides are critical for understanding of electronic and structural dynamics of these materials upon photoexcitation. By applying ultrafast diffraction conoscopy along with traditional pump-probe spectroscopy techniques we reconstructed the thermodynamic potential of the material far from equilibrium. This enables numerical modeling of the pathways for lattice transformation in terms of Ginzburg-Landau formalism. Additional numerical modeling of the molecular dynamics of VO2 and V3O5 shows a good match with the experiment. Using time- and angle-resolved light scattering techniques we visualize mesoscale statistics of the insulator-to-metal phase transition, including coherent phonon response of local domains with different sizes and orientations. We show a significant influence of the misfit strain in epitaxial films of vanadium oxides on subpicosecond phase transition dynamics. The tensile and compressive strain shifts the phase of coherent phonon oscillations in different domains. The observation of phonon mode softening at quasi-equilibrium and upon ultrafast photoexcitation enables a new understanding of symmetry-breaking in vanadium oxide materials.

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