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Strain-dependent ultrafast dynamics of insulator-to-metal phase transition in VO2[1] SERGIY LYSENKO, ARMANDO RUA, JOSE FIGUEROA, FELIX FERNANDEZ, Department of Physics, University of Puerto Rico, Mayaguez, Puerto Rico 00681, USA — Much attention has been devoted recently to visualize and understand the strain effects in phase transition dynamics of vanadium oxide materials. In this study, using femtosecond angle-resolved light scattering technique we show strong influence of internal misfit strain in epitaxial VO2(M1) films on insulator-to-metal phase transition within less than 1 ps. Anisotropic strain in twinned domains and in domains of different size results mostly in antiphase oscillatory dynamics of coherent phonons. Depending on domain pattern and type of the substrate, this dynamics was found to be dependent on azimuthal angle and/or on spatial frequency of surface roughness. The origin of observed photoinduced antiphase oscillations is associated with compressive and tensile strain in VO2 domains which alters the initial phase of the oscillations. In contrast to pure VO2(M1), the Cr-doped VO2(M2) shows strong phonon scattering signatures with noticeable random component in the phase of coherent phonons.

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