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Title:THz spectroscopy of VOinf2/inf epitaxial films: Controlling the anisotropic properties through strain engineering

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Abstract:We use THz time-domain spectroscopy to investigate the farinfrared properties of vanadium dioxide thin films, strain-engineered through epitaxial growth on (100)R TiOinf2/inf substrates. The films exhibit a large uniaxial tensile strain along the rutile c-axis. X-ray diffraction measurements reveal a structural transition temperature of 340 K, whereas independent THz conductivity measurements yield a metal-insulator transition temperature of 365K along cinfR/inf. Analysis of these results suggests a Mott-Hubbard behavior along the cinfR/inf-axis. Along cinfR/inf the conductivity is approximately 5500 (Ω cm)sup-1/sup, comparable to bulk single crystals. The tensile strain leads to remarkably uniform cracking oriented along the rutile c-axis, resulting in a large conductivity anisotropy in our single-crystal epitaxial thin films. We discuss our results in the context of previous measurements and calculations of the properties of VOinf2/inf, under different strain conditions. This work demonstrates the potential of strain engineering to tune the properties of complex materials while also serving as a powerful discriminatory tool for probing microscopic responses. © IOP Publishing Ltd and Deutsche Physikalische Gesellschaft.

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Controlled terms:Anisotropy - Epitaxial films - Epitaxial growth - Oxide minerals - Semiconductor insulator boundaries - Temperature - Titanium dioxide - X ray diffraction

Uncontrolled terms:Anisotropic property - Bulk single crystals - Complex materials - Conductivity measurements - Epitaxial thin films - Far-infrared - Microscopic response - Strain conditions - Strain engineering - Structural transition temperature - Thz spectroscopy - THz time domain spectroscopy - TiO - Uniaxial tensile strain - Vanadium dioxide thin films - X-ray

diffraction measurements

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