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Title:Effect of substrate orientation on terahertz optical transmission through VO<sub>2</sub> thin films and application to functional antireflection coatings

Authors:Yanhan Zhu (1); Yong Zhao (1); Holtz, M. (2); Zhaoyang Fan (1); Bernussi, A.A. (1)

Author affiliation:(1) Dept. of Electr. & Comput. Eng., Texas Tech Univ., Lubbock, TX, United States; (2) Dept. of Phys., Texas Tech Univ., Lubbock, TX, United States

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Abstract:We report studies of the terahertz (THz) transmission through vanadium dioxide (VO<sub>2</sub>) thin films grown on c-, m-, and r-plane sapphire substrates. Our results revealed THz amplitude modulation as large as 84% for VO<sub>2</sub> films grown on r-plane sapphire substrates upon crossing the metal-insulator phase transition temperature. Complex optical conductivity and refractive indices were determined for all investigated samples in the metallic state. Results are consistent with electrical resistivity measurements and described based on the Drude model. The real and imaginary parts of the optical conductivity and refractive index are obtained, and associations with variations in the grain morphology and crystal quality are described. We show that VO<sub>2</sub> thin films can be used as tunable broadband THz frequency antireflecting coatings.

Number of references:32

Inspec controlled terms:antireflection coatings - electrical resistivity - metal-insulator transition - optical conductivity - optical films - optical modulation - refractive index - terahertz wave spectra - vanadium compounds

Uncontrolled terms:substrate orientation - terahertz optical transmission - functional antireflection coatings - vanadium dioxide thin films - m-plane sapphire substrate - r-plane sapphire substrate - c-plane sapphire substrate - THz amplitude modulation - metal-insulator phase transition temperature - optical conductivity - metallic state - electrical resistivity measurements - Drude model - refractive index - grain morphology - crystal quality - tunable broadband THz frequency antireflecting coatings - VO<sub>2</sub> - Al<sub>2</sub>O<sub>3</sub>

Inspec classification codes:A7870G Microwave and radiofrequency interactions with condensed matter - A4280X Optical coatings - A7130 Metal-insulator transitions and other electronic transitions - A7360H Electrical properties of insulators (thin films/low-dimensional structures) - A7820D Optical constants and parameters (condensed matter) - A7865P Optical properties of other inorganic semiconductors and insulators (thin films/low-dimensional structures)

Chemical indexing:VO2/bin O2/bin O/bin V/bin;Al2O3/sur Al2/sur O3/sur Al/sur O/sur  
Al2O3/bin Al2/bin O3/bin Al/bin O/bin

Treatment:Experimental (EXP)

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