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Competitive Growth Texture of Pulse Laser Deposited VO2 Nanostructures on Glass Substrate

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Abstract content
   (Max 300 words)

Vanadium dioxide is a strongly correlated transition metal oxide with a first-order insulator-to-metal transition (IMT) at $67\ ^{\circ}$ C and its potential applications ranging from femtosecond optical switching to thermal-management coatings. The IMT exhibits large changes in resistivity and near-IR transmission accompanied by a nearly simultaneous structural change from low-temperature monoclinic form with band-gap of about 0.7 eV to a high temperature, tetragonal rutile phase. The phase transition is generally agreed to arise from a combination of Mott and Peierls mechanisms. High-quality thin films are crucial for technologies that capitalize on the IMT. It is well known that film microstructure film/substrate interface and localized strain of VO2 can affect the hysteresis characteristics of the phase transition. VO2 synthesis is also complicated by the narrow temperature-pressure window in phase space, due to multiple valence states of vanadium. The report is based on the crystal structure and morphology of VO2 nanostructures synthesized by pulsed-laser deposition on soda lime glass. The VO2 nanostructures exhibit sharp a-axis diffraction peaks, characteristic of the VO2 monoclinic phase, which implies that highly a-axis textured VO2 was formed. A detailed description of the growth mechanisms and the substrate/film interaction is given, and the characteristics of the electronic transition and hysteresis characteristics of the phase transition are described by the morphology and grain boundary structure. The sharpness of the transition and the hysteresis upon heating and cooling are found to be a strong function of crystal structure and microstructure (grain size, and shape).

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