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Scanning X-ray Diffraction Microscopy of Ion Irradiated VO2

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Vanadium dioxide undergoes a phase transition from an insulating, monoclinic (M1) phase at low temperatures to a metallic, rutile (R) phase above 68 ˚C. Since the two phases show distinctly different electrical conductivity and absorption in the near infrared VO2 is interesting for "smart"electrical and optical components or window coatings. Ion beam irradiation decreases the transition temperature, making it an interesting tool for technological application, esp. for controlled patterning when considering the high special resolution and flexibility obtainable with focused ion beam (FIB) systems.
Here we present scanning X-ray diffraction microscopy results on two distinct sample arrangements of VO2. First, single crystalline VO2 microwires were investigated. They clearly show patterned FIB irradiation induced strain patterns and the coexistence of metallic and insulating phases in very close proximity within a single crystal. Secondly, a nanocrystalline thin film of VO2 was nanostructured with FIB irradiation. We show that for a given film thickness an optimal irradiation dose yields a high contrast in the phase transition. In this patterned thin film it seems that the boundary lines between patterned surfaces preferentially follow the granularity of the film.

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