Regulating the Phase Transition of Vanadium Dioxide Thin Films

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Vanadium dioxide (VO_2) is a popular thermochromic material owing to its potential applications in intelligent windows, sensors, and diverse electronic devices. VO_2 displays a distinctive metal-insulator transition (MIT) that occurs around 68°C temperature, which is accompanied by a structural transition and a dramatic change in the optical properties [1]. During this transition, the material shifts between its low-temperature insulating (transparent to near infrared rays) monoclinic phase (M1) and its high-temperature metallic (opaque to near infrared rays) rutile phase (R). From application perspective, it is highly imperative to stabilize VO_2 thin films with control on the phase transition properties. Ion-implantation is one of the effective route to tune the properties of VO_2 thin films [2, 3]. In the present work, we have studied B+ ion implanted VO_2 thin films.

Thin films of VO_2 were prepared by radio frequency (RF) magnetron sputtering technique. Apart from the pristine sample, three samples were implanted by B+ ions at different fluence ranging 5×10^{13} ions/cm^2 to 5×10^{14} ions/cm^2. B+ ions implanted VO_2 thin films revealed modified structural, electrical and optical properties. Structural phase transition and MIT temperatures were found to decrease with increasing implantation dose. Moreover, for ion-implanted VO_2 thin films, temperature dependent transmittance measurements depicted the shift in optical transition towards room temperature side. Such control of phase transition in VO_2 thin films is very crucial for device applications.

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