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Fabrication of device quality VO_2 thin films

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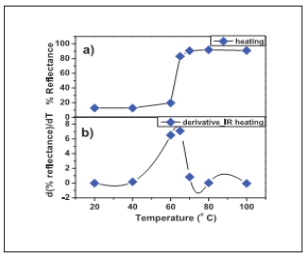

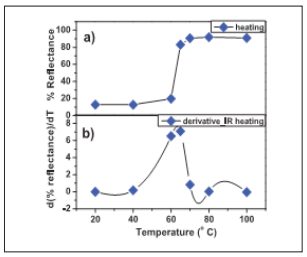

Semiconductor to metal transition (SMT) in metal oxide is the most fascinating field of research in materials science. This transition can be triggered by thermal, electrical, strain, etc. where oxides show a drastic change in resistivity. Large number of oxides are known to show this kind of transition but VO_2 shows this transition near to room temperature (T_{SMT} ~68 °C). It undergoes a change in crystal structure from monoclinic phase (M1, $P2_{1/c}$) to tetragonal phase (R, $P4_{2/mnm}$). Due to this phase transition it has been used for various applications like smart windows, metamaterial, bolometers, etc. Herein, we report the synthesis of device quality VO_2 thin films. Various methods like home-built Ultrasonic Nebulized Spray Pyrolysis of Aqueous Combustion Mixture (UNSPACM), Chemical Vapor Deposition (CVD), Pulsed Laser Deposition (PLD) and DC Reactive sputtering have been employed to synthesize the thin films. The structural characterization of the thins films have been carried out by XRD and Raman measurements which confirms the M1 phase of VO_2 at room temperature followed by high temperature measurements to study the phase change to R phase. A temperature dependent resistance measurement confirms the SMT transition at 68 °C with a three-four order of magnitude change in resistance. Temperature dependent IR measurements show ~80% change in reflectance across the phase transition where the thin film acts as an IR reflector ($T>T_{SMT}$). Effect of substrate, synthesis process, post-annealing on SMT have been studied.

References

1. Yang Z, C Ko and S Ramanathan (2011) Oxide Electronics Utilizing Ultrafast Metal Insulator Transitions. *Annual Review of Materials Research*; 41(1): 337-367.
2. Good enough J B (1971) The two components of the crystallographic transition in VO_2. *Journal of Solid State Chemistry;* 3(4): 490-500.

Recent Publications

1. R Bharathi, A M Umarji, et al. (2017) Thermochromic VO_2 thin films on ITO-coated glass substrates for broadband high absorption at infra-red frequencies. *Journal of Applied Physics;* 122(16): 163107.
2. Pradhan J K, A M Umarji, et al. (2017) High contrast switchability of VO_2 based metamaterial absorbers with ITO ground plane. *Optics Express;* 25(8): 9116-9121.

Biography

Arun M Umarji had pursued his PhD from IIT and held Postdoctoral positions at Argonne National Laboratory, USA and at TIFR in Mumbai. He has been a Faculty Member of the Materials Research Centre since 1987. He was a Visiting Faculty Member at the Ceramics and Materials Engineering Department, Rutgers University, USA.

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