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Tuning transport properties of VO_2 thin films by reducing film thickness in the nanoscale region

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Micro and Nano Thin films of VO2 were fabricated by inorganic sol gel method using V_2O_5 and H_2O_2 as initial precursors on glass substrates. XRD spectra were performed to confirm VO_2 phase purity of both the samples. The RBS results estimate a layer thickness of 15 and 291 nm for nanothin and micro thin films, respectively (Figure 1).

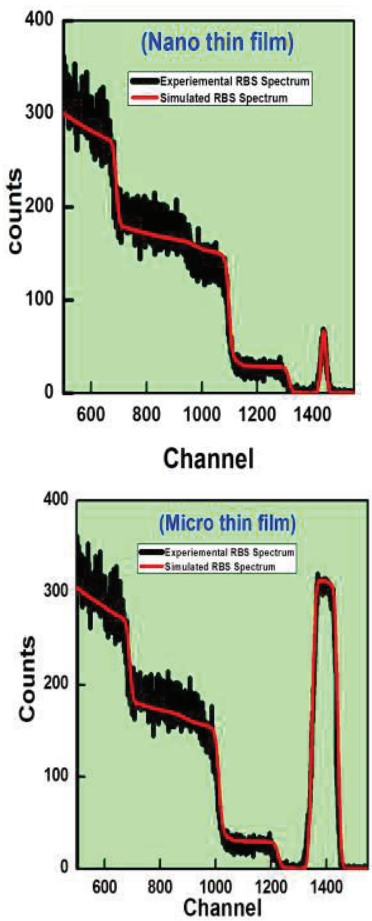

Figure 1: RBS spectra of Nano and micro thin film showing VO_2 composition and thickness of films

SEM micrographs of films displays that there are regular and irregular crystallites of a cuboidal shape. Estimation of crystallite size revealed that nanothin films attain poor crystallinity as compared with micro thin films. R-T measurements demonstrate that transition temperature can be tuned towards the room temperature by reducing the dimensions from microscale to nanoscale without the use of any dopant. Thermoelectrical studies show that value of seebeck coefficient increases by few times upon reducing the dimensions in the nanoscale region. Enhancement of seebeck coefficient has been understood on the basis of filtering of charge carriers along the grain boundaries (figure 2).

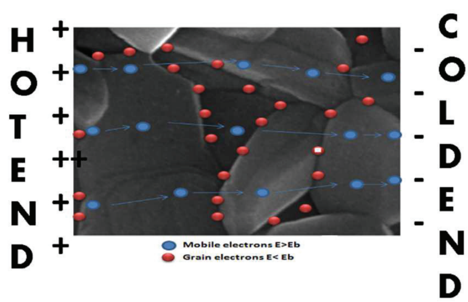

Figure 2: Schematic diagram showing filtering of charge carriers along grain boundaries

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