Study of the thermochromic performance of hydrothermally synthesized Vanadium dioxide powder for energy efficient buildings

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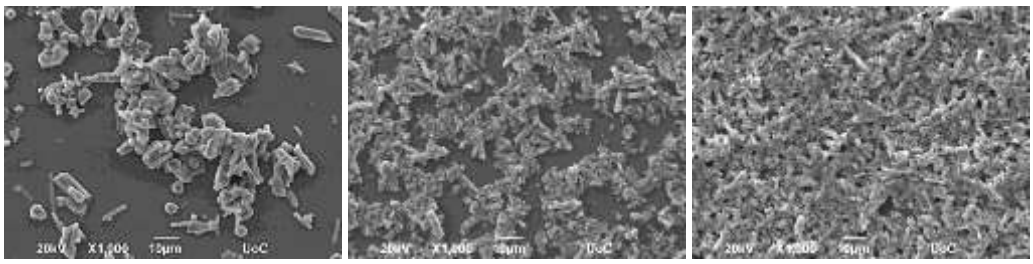
Thermochromic materials are known to modify their optical properties upon heating. Vanadium dioxide (VO_2) is by far the most studied thermochromic material, undertaking a first order Metal to Insulator Transition-MIT at a critical transition temperature of T_C = 68°C, close to room temperature. This electrical transition is accompanied by structural as well as optical changes. Thus, it can be used in numerous applications such as thermochromic coating on "smart" windows, thermal switch in electronic circuits, etc. [1]. VO_2 in powder form can be potentially used as a thermochromic coating in polymer matrix [2] as well as in thermochromic paints. In the present work, the thermochromic performance of hydrothermally synthesized VO_2 powder was investigated. In particular, the effect of the reducing agent during synthesis and the duration of post-processing ball-milling on the thermochromic properties were studied. X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Differential Scanning Calorimetry (DSC) characterization techniques were employed to determine the structure, morphology and thermochromic performance of VO_2, respectively. Oxalic acid, among other reducing agents, was found to be the reducing agent that led to VO_2 powders with the better thermochromic performance. Moreover, the duration of the post-processing ball-milling seems to strongly affect the morphology (Fig. 1) as well as the thermochromic properties of synthesized VO_2.



0 min **120 min** **240 min**

Figure 1: Effect of the ball-milling duration on the morphology of hydrothermally synthesized VO_2 powders.

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