Synthesis and Characterization of VO_2 (M) Nanocomposites and The Applications of Nanothermochromism to Smart Architecture Glazing

Chang LIU[a,1], Yi LONG[a,2]

[a] School of Materials Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798
[1] LIUC0036@E.NTU.EDU.SG; [2] LONGYI@NTU.EDU.SG

Abstract

Vanadium dioxide (VO_2) has been a leading thermochromic material. The M (monoclinic) phase of VO_2 exhibits an excellent temperature-responsive behavior at a critical temperature (τ_c) at 341K (68°C), near the room temperature, which makes it a promising candidate to smart architecture glazing [1]. VO_2 is able to adjust the inflow of solar heat by switching the transmittance in the infrared (IR) region (780 nm – 2500 nm), while maintaining the visible transmittance. However the main obstacles of VO_2 to commercialization in large scale are low luminous transmittance (T_{lum}) while maintaining high solar modulation ability (ΔT_{sol}) due to strong light absorption in the visible wavelength [2, 3]. To tackle this issue, Li S. Y. *et. al.* proposed nanothermochromism, which was defined as integrating VO_2-based nanoparticles into transparent matrix. It was claimed that VO2 nanoparticles dispersed in a dielectric host are more advantageous than VO2 continuous thin solid films in smart window applications as they offer much higher T_{lum} and enhanced ΔT_{sol} [4]. In this project, the innovative VO_2 nanocomposites were well-prepared via industrial scalable techniques (bead-milling + casting) to migrate bead-milled VO_2 nanoparticles with the size below 50nm into the supporting matrix (Si-Al gel or PMMA). The aim of this project is to conquer the challenges of enhancing both luminous transmittance (T_{lum}) and solar modulation ability (ΔT_{sol}).

References

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