Title: 3D mesoporous structure assembled from monoclinic M-phase VO_2 nanoflakes with enhanced thermochromic performance

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Abstract

Monoclinic M-phase VO_2 is a promising candidate for thermochromic materials due to its abrupt change in the near infrared (NIR) transmittance along with the metal-to-insulator transition (MIT) at a critical temperature ~68 °C. However, low luminous transmittance (T_{lum}), poor solar energy modulation ability (ΔT_{sol}), and high phase transition temperature (T_c) can limit the application of VO_2 for smart windows. To overcome these limitations, 3D mesoporous structure can be employed in VO_2 films. Herein, 3D mesoporous structures assembled from monoclinic M-phase VO_2 nanoflakes with a pore size of about 2–10 nm were synthesized by a hydrothermal method using *Ensete ventricosum* fiber (EF) as a template followed by calcination at 450 °C. The prepared film exhibited excellent thermochromic performance with balanced T_{lum} = 67.3%, ΔT_{sol} = 12.5%, and lowering T_c to 63.15 °C. This is because the 3D mesoporous structure can offer the uniform dispersion of VO_2 nanoflakes in the film to enhance T_{lum}, ensure sufficient VO_2 nanoflakes in the film for high ΔT_{sol} and lower T_c. Therefore, this work can provide a green approach to synthesize 3D mesoporous structures assembled from monoclinic M-phase VO_2 nanoflakes and promote their application in smart windows.

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