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Fabrication and formation mechanism of porous VO$_2$ thin films with superior thermochromic performances

Haizheng Tao$^a$, Benqin Zhu$^a$, Wenyuan Zhang$^a$, Meinan Wan$^a$, Changlin Zhao$^a$, Xiujian Zhao$^a$, Yuanzheng Yue$^{a,c}$

$^a$State Key Laboratory of Silicate Materials for Architectures, Wuhan University of Technology, Wuhan 430070, China
$^b$Section of Chemistry, Aalborg University, 9000 Aalborg, Denmark

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VO$_2$ is the most ideal thermochromic material, which is often used for making smart windows with a transition temperature close to room temperature. Its thermochromic performances can be enhanced by introducing well-distributed pores. However, it is a challenge to form well-distributed pores in the high pure M/R phase VO$_2$ film. Here we report on a novel, cost effective one-step method to create well-distributed pores while ensuring the formation of relatively high pure M/R phase VO$_2$ thin films. The derived single-layer thin film exhibits superior thermochromic performances, e.g., high luminous transmittance (~60%) and large solar modulating ability (~8.5%). These findings open a new vista for fabrication of porous VO$_2$ thin films with outstanding thermochromic properties. We also present some results about the thermal, mechanical and chemical stabilities of the thin film and discuss the mechanism of the interconnection between the film and the glass substrate.

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