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Non-UV activated superhydrophilicity of patterned Fe-doped TiO₂ film for anti-fogging and photocatalysis

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Abstract

Fe³⁺-doped TiO₂ films with the pattern surface were fabricated onto glass substrates by a facial photosensitive sol-gel method. The patterned TiO₂ film has anatase crystallites and a micro- and nanometer-scale hill-to-valley hierarchical surface structure. The hydrophilicities of all TiO₂ films stored in the dark for a long time were evaluated by measuring the water contact angle (CA) without being illuminated by ultraviolet (UV) light in advance. The results demonstrated that water droplets could quickly spread onto the surface of the patterned TiO₂ film, resulting in a low CA. The patterned TiO₂ film with the lowest period of 2 μm showed the lowest CA of 2° within 3 s. This indicated that the patterned TiO₂ film had the good superhydrophilicity without any UV activation. The wetting behavior of the patterned TiO₂ film followed the Cassie impregnating wetting regime, and the dynamic to hydrophilic state was attributed to the capillary effect. The patterned TiO₂ film also had the non-UV induced anti-fogging performance and exhibited a good photocatalytic activity to decompose methyl orange pollutant.

Keywords: TiO₂ film; Pattern; Superhydrophilic; Anti-fogging; Photocatalysis

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