Influence of Pore Aperture and Pore Density on Photoelectrochemical Performance of Titanium Dioxide Nano-Porous Thin Films

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In this paper, preparation of titanium dioxide nano-porous thin films was conducted by electrochemical anodic oxidation. Fluorescence spectrometry, UV-vis absorption spectrometry and electrochemical methods, including electrochemical impedance spectroscopy, chronoamperometry and open-circuit potential time curve test, were used to characterize the photoelectrochemical performance of titanium dioxide nano-porous thin films. Effects of the pore structure, such as average aperture and pore density, on the photoelectrochemical performance of titanium dioxide nano-porous thin films were investigated in detail. The results revealed that TiO₂ nano-porous thin films showed much better photoelectrochemical properties under the illumination of simulated sunlight. The larger the specific surface area, the better the photoelectrochemical performance. When the average aperture and pore density were 103 nm and $1 \times 10^9 \text{ cm}^{-2}$, TiO₂ nano-porous thin film exhibited the optimum photoelectrochemical performance.

Keywords: TiO₂; nano-porous; average aperture; pore density; anodic oxidation

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