Improving the Photocatalytic Properties of TiO₂ Coatings by Modification of the Pore Size and the Crystalline Structure by Combining Anodization and MAO Technology

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A TiO₂ coating with regular pore parameters was fabricated on the surface of pure titanium metal. The pore size and crystalline structure of the coating were modified by combining anodizing and micro arc oxidation technology. The cross-section and micro-surface of the anodic coating were observed by SEM, which suggested that the pore size of the anodic coating can be adjusted to 81 nm by using sulfuric-phosphoric acid as the electrolyte. The micro-surface of the coatings was characterized by SEM after MAO treatment, and ImageJ software was used to study the porosity of the coating. The results proved that when the current density was 30 mA/cm², the porosity of the coating was 20.12 %, and few microcracks were found on the surface of the coating. The crystalline structure of the coating was studied by XRD, and the results proved that anatase can be transformed into a rutile crystalline structure by MAO technology. The absorbance of the coating was tested and compared with that of TiO₂ powder by UV-vis spectroscopy; the results proved that the absorption wavelength range of the coating became wider after it had been treated by anodizing and MAO technology. The activity and stability of the photocatalyst was studied by measuring the absorbance of a methyl orange solution before and after treatment with the coating, and the results proved that the coating had better activity in the degradation of methyl orange. After the photocatalyst had been used 5 times, the specific activity of the coating exceeded 85 % of that of the new photocatalyst.

Keywords: TiO₂ coating; photocatalyst; anodizing; micro arc oxidation; pore size; crystalline structure

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