OBTAINING TiO_2 WITH NANOPOROUS STRUCTURE BY CHEMICAL CORROSION AND THERMAL OXIDATION OF TI FOILS

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Abstract

Over the past years, titanium dioxide (TiO_2) has known an increased interest in different applications such as gas sensors, photocatalysis, solar cells, etc, due to its vast properties. An improvement of the catalytic properties can be obtained by the increased surface area of the nanoporous titanium oxide. The thermal oxidation process is a very well-studied field, for the growth of nano and micro oxide structures, having several advantages over other methods based on chemical techniques, such as low production cost and large-scale production of metal oxide.

In this study an aqueous mixture of HF was used as a corrosive solution, having the role of increasing the surface area by chemical corrosion in the surface of the titanium foils. Due to the intergranular boundaries, as well as the crystalline defectsof the metal, the corrosive solution attack differently the surface of the 99.99% purity Ti foils, resulting in a nanoporous titanium structure on the surface. After the chemical corrosion process, the titanium plate was washed with distilled water, then dried in vacuum. For the achievement of titanium oxide with nanoporous structure having a ligament form morphology, thermal oxidation process has been applied, in a controlled atmosphere consisting in a mixed gas flow of Ar and O_2, at a temperature of 500 ℃. In this study we followed the variation of titanium oxide nanoporosity depending on the corrosion time (1h and 2h) in the 0.5 M HF and chemical concentration of HF aqueous solution (0.05 and 0.01 M HF) at 24 h holding time keeping both the temperature and the holding time of the thermal oxidation process constant, at 500 ℃ for 4h. Scanning electron microscopy (SEM), X-ray diffraction (XRD), and UV-Vis spectroscopy were used to characterize the TiO_2 nanostructure.

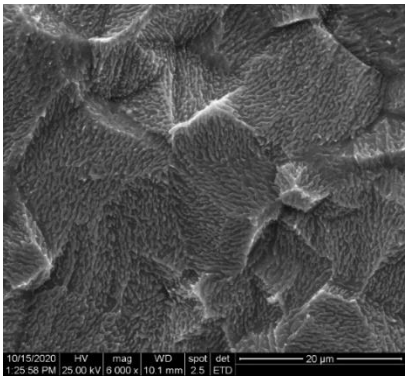

Figure 1. Scanning electron microscopy (SEM) image of TiO_2 grown by thermal oxidation (500℃/4h) on corroded Ti foils (0.5 M HF/2h)

Acknowledgements

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