

Passivity Breakdown and Growth of Self-Organized Porous Titanium Oxide

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Anodization of titanium is investigated in H₂SO₄ electrolytes containing low concentrations of HF (0.05 – 0.4 wt%). It is found that under optimized electrolyte conditions and extended polarization, highly ordered porous TiO₂ is obtained, that consists of pore arrays with single pore diameters of 140 nm and a pore spacing of 150 nm. During the formation process significant current oscillations are observed – the amplitude strongly depends on the HF content of the electrolyte. Electrochemical, SEM and XPS investigations show that the porous layer forms under a competition of TiO₂ formation and oxide dissolution up to a limiting thickness of ≈500 nm, and that the time scale for complete self-ordering for the investigated systems is in the order of several hours. An example is shown in Fig. 1.

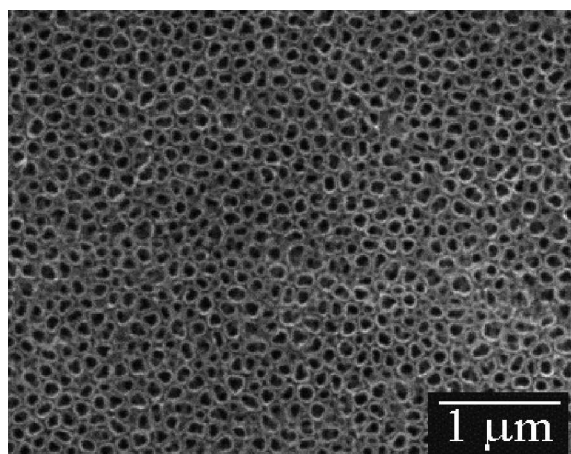


Fig. 1: SEM image of titanium anodized at 20 V in H₂SO₄ (1 M) + HF (0.15 wt%) for 24 hours.