

Fabrication of Single Crystalline Brookite TiO₂ Nanoarrays, and Their Application to Photoelectrochemical Cell and Field Emission

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TiO₂ has been considered as promising materials for optoelectrical applications including photovoltaic cells, optical sensors, and dye-sensitized solar cells. TiO₂ has three major crystalline polymorphs : rutile, anatase, and brookite. Research on Brookite has been less focused on compared to anatase and rutile, because brookite rarely exists in nature, and it is difficult to synthesize.

In this research, various TiO₂ nanostructures were synthesized on titanium foil, by facile one-step hydrothermal reaction. Synthesized TiO₂ can have four morphologies which are sheet, tube, wire, and pyramidal shape. The morphology was observed using SEM and TEM, and the crystalline structure was confirmed by SAED pattern of TEM and XRD analysis. As a result of TEM and XRD analysis, we found wire, sheet, and tube structures were anatase, and pyramidal structure was brookite.

The photoelectrochemical properties and the field emission properties of various TiO₂ nanostructure were measured. The brookite had the highest photoelectrochemical properties compared to other morphologies of anatase with similar length.