Synthesis of titania nanotube films by electrochemical anodization and their photo-electronic applications
二氧化钛薄膜制备和光电子应用

二氧化钛是一种多功能半导体材料。基于二氧化钛的纳米管结构更是表现出与众不同的物理和化学性质，并在很多领域具有重要的应用。电化学阳极氧化方法具有简单方便，可精确控制形貌结构等优点而越来越受到重视。我们通过一系列电化学参数控制其生长过程，包括二氧化钛纳米管的形貌，管长，管径，管壁厚度等。我们通过研究电化学参数对二氧化钛纳米结构的影响，获得完备的调控纳米结构形貌尺寸的实验方法。在这些研究的基础上，设计制备新型结构的二氧化钛纳米材料，使其具有独特的光电子性质和功能。

Titania is an important functional semiconductor material. The nanotube structures based on titania have shown advanced physical and chemical properties, and have been explored for broad applications. Among several synthesis strategies, electrochemical anodization is a facile and excellent approach to fabricate nanotube array films with precisely controlled morphologies and structures. By investigating the different anodization parameters, tunable geometry and architectures (tube sizes, lengths, wall thicknesses) can be synthesized. We have also successfully synthesized advanced titania nanotube materials for various photo-electronic applications.

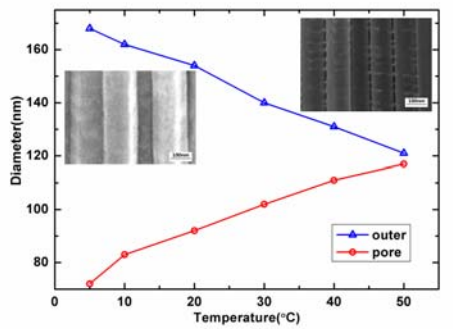

Figure 1 | Relation between tube diameters and anodization temperature
图1 |管径和生长温度的关系

The results provide the possibility for the precise control over tube morphologies and structures.

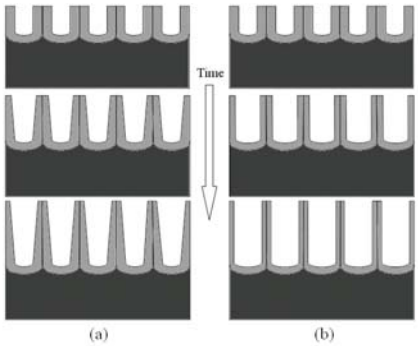

Figure 2 | Schematic representation of tube formation: (a) V-shaped tubes at fixed temperature; (b) U-shaped when temperature gradually elevated.
图2 |获得均匀管径的纳米管

Because the U-shaped nanotube arrays have larger effective surface, they will show better properties and may have broad potential applications.

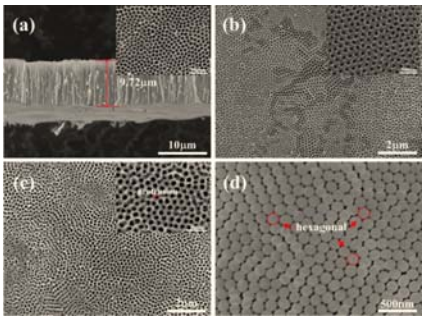

Figure 3 | FE-SEM images showing free-standing nanotube layers with both ends open
图3 |两端开孔薄膜的制备

Figure 4 | Optical photographs of tube membranes with different colors.
图4 | 彩色薄膜

We obtained the free-standing, highly ordered and optical active membranes with various structural colors over the entire visible spectrum, reaching the photons manipulating.

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