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Micro-Structured Crystalline Device in Confined Space, a Dye-Sensitized Solar Cell, and Method of Preparation Thereof

Researchers at the University of South Florida have developed a novel technique for manufacturing micro or nano structures in confined spaces. This wet chemistry technique was developed to produce aligned Zinc Oxide nanowires.

Zinc Oxide nanowires are used as an electrode material in a number of devices such as dye sensitized solar cells (DSSC). One of the advantages of using them is having high specific surface area. Techniques such as high aspect ratio nanowires or hierarchical nanowires are used to produce ZnO nanowires with high specific surface area.

Zinc Oxide nanowires are commonly grown on flat surfaces of a substrate. However, if grown inside complex three dimensional structures such as deep trenches, the specific surface area of the nanowires would dramatically increase. Conventional hydrothermal growth of ZnO nanowires provides no space for replenishing chemicals that are necessary for the growth inside the trenches.

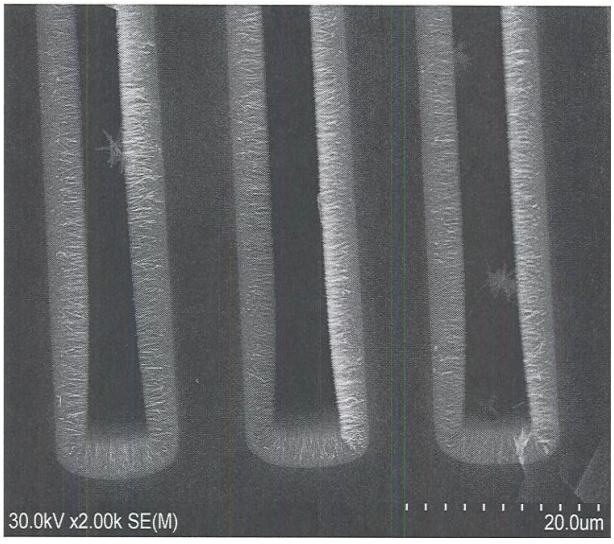
USF researchers have developed a novel technique to fabricate ZnO nanowires inside an array of high aspect ratio deep trenches. The hydrothermal growth of Zinc Oxide nanowires in these confined spaces is enabled by pumping the heated growth solution through microfluidic channels partially formed by a set of high aspect ratio trenches in the substrate. Zinc Oxide nanowires are formed inside the trenches, where they would not grow if a conventional hydrothermal method were used. These nanowires are aligned and uniformly distributed on the bottom and side walls of every trench.

Such a structure may be beneficial when Zinc Oxide nanowires are used as an electrode material for devices like DSSCs, supercapacitors or any other electrochemical device.

ADVANTAGES:

- **High surface area nanostructure**
- **Uniform nanowire growth in a confined space**
- **Greater electron transport**

A New and Novel Nano Wire Fabrication Method



SEM Image of ZnO Nanowires Hydrothermally Grown Inside Deep Trenches using Described Methodology Lower Part of the Trenches

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