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Zinc Oxide Nanowire Growth for Dye- Sensitized Solar Cells

One of the most pressing challenges facing humans today is the development of clean, efficient methods of utilizing solar energy. The dye-sensitized solar cell (DSSC) is a promising option for efficient, low cost solar energy conversion with minimal ecological impact. The basis for one of the DSSC designs is an array of dense, aligned zinc oxide nanowires grown on a transparent conducting oxide in an aqueous solution of zinc nitrate hexahydrate and methenamine. It has been shown that concentration of chemicals in the growth solution and temporal evolution of the solution temperature strongly affect the morphology of the resulting wires. I synthesized wires with various temperature treatments and used titrations and pH measurements to monitor depletion of the zinc ions in the growth solution as a function of reaction time. I used scanning electron microscopy to observe the growth of the nanowires. Preheating methenamine and zinc nitrate solutions separately and then mixing them caused a sharp drop in zinc ion concentration and pH, and did not result in ZnO nanowire growth. Wires were only produced when the chemicals were mixed together at room temperature and then heated gradually. This observation is explained by hypothesizing that a high solution pH and high concentration of zinc ions are necessary for ZnO nucleation. The results of these and future experiments will be used to determine optimal temperature treatments and propose a mechanism for ZnO growth.



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