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# The Effect of Varying Tungsten Oxide Morphologies on Photocatalytic Activity for Carbon Dioxide Reduction

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Tungsten oxide is a cost efficient and environmentally friendly semiconductor photocatalyst that can reduce the amount of carbon dioxide in the atmosphere, by converting carbon dioxide into useful chemical fuels. There are many different crystal structures and compositions of tungsten oxide, which vary in their photocatalytic activity. In this project, we varied the synthesis conditions and then characterized the samples to identify which conditions led to samples with active morphologies for photocatalysis. The four distinct morphologies based on different alcohol solvents and tungsten precursor concentrations were nanoscale rods, wires, stars, and platelets. We used X-ray diffraction and transmission electron microscopy to characterize the samples. Among the four morphologies, tungsten oxide nanowires had the highest photocatalytic activity based on the dye transformation of resazurin, a non-fluorescent molecule, to resorufin, a fluorescent molecule whose presence was measured with fluoresce spectroscopy. The most promising nanowire samples were then used in the reduction of carbon dioxide to formic acid and ethanol. Continued work will be focused on increasing the yield of product formed from this carbon dioxide reduction and producing methane gas by working to increase the oxygen vacancy concentration on the tungsten oxide nanowires.