Photothermochemical CO2 reduction
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The objective of this project is to develop and test nanostructured catalysts for the photothermochemical reduction of CO2 to fuels. The design of the photoreactor as an artificial photosynthetic system is especially intriguing since it requires optimization of multiphase transport at multiple length scales, complex reaction kinetics, and light coupling. In collaboration with the Erickson Lab (MAE, Cornell) we endeavor to integrate optimized light delivery and nanoparticle catalyst functionalization. The specific objective is to develop catalysts based on silicon particles. The student will compare the performance of hydrogen terminated and indium oxide functionalized catalyst. The catalysts will be integrated into either a static or fluidized photothermochemical reactor. Students working on this project should grain proficiency in synthesis of colloidal nanocrystals and functional ligands and nanofabrication in a custom-made 3D printer.
Students will also gain expertise in the following characterization techniques: small- and wide-angle x-ray diffraction, scanning electron microscopy (SEM), energy dispersive spectroscopy (EDX), transmission electron microscopy (TEM), and Fourier transform infrared spectroscopy (FTIR).