Thrust Area 4: Solar (Thermal)

Development of Novel Water Splitting Catalysts for the Production of Renewable Hydrogen

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Description: This project focuses on the development of iron-based catalysts for the thermochemical splitting of water into hydrogen and oxygen. The thermochemical process of splitting water is particularly well-suited for the utilization of solar energy to provide the heat for the reaction and is a way to produce a renewable hydrogen fuel. As hydrogen is difficult to transport and store, producing hydrogen on site for power plants using proton exchange membrane (PEM) fuel cells or internal combustion engines to generate electricity or for the production of chemicals, such as liquid hydrocarbon fuels, is a very attractive approach. The project uses a two-step process in which water is passed over a reduced iron oxide to generate hydrogen while the oxygen is taken up by the oxygen-deficient iron oxide (Step 1: FeOx-1 + H2O FeOx + H2). In the second step the resulting iron oxide is heated to desorb oxygen and regenerate the oxygen-deficient iron oxide to close the catalytic cycle (Step 2: FeOx FeOx-1 + ½O2). The main objectives of the project are to develop mixed metal oxide catalysts that 1) will release oxygen at temperatures lower than 1500°C (Step 2), while still maintaining water-splitting activity (Step 1) and 2) are stable up to the temperature necessary for the oxygen desorption step.

Budget: $ 100,000
Universities: UF

Progress Summary

We have initiated the research and designed the reactor system (Figure 1), purchased a high temperature furnace and are in the process of purchasing a mass spectrometer (MS) for product analysis.

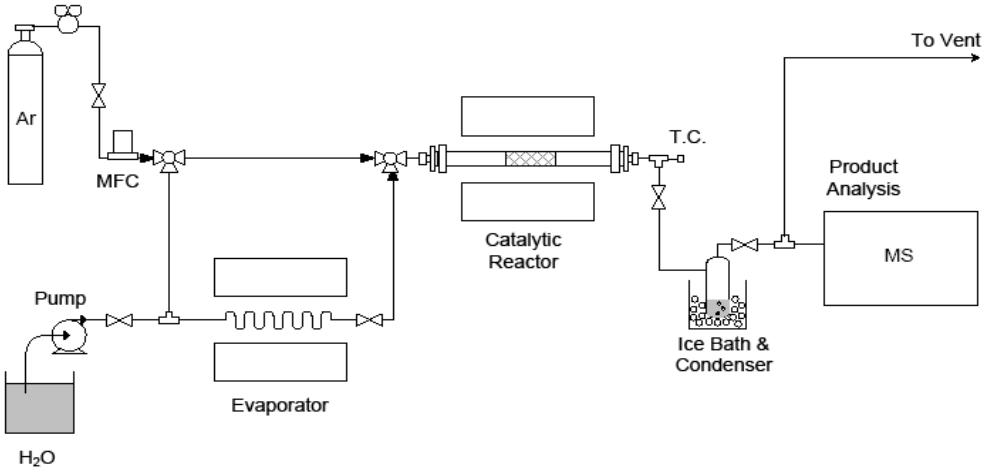

Figure 1: Drawing of reactor system for reaction studies on developed water-splitting catalysts (MFC = mass flow controller, T.C. thermocouple, MS = mass spectrometer).