Alliance for Molecular PhotoElectrode Design for Solar Fuels (AMPED)

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AMPED EFRC MISSION:

To Develop the Fundamental Molecular Basis for Solar-Driven Water Oxidation and Carbon Dioxide Reduction Catalysis.

RESEARCH PLAN:

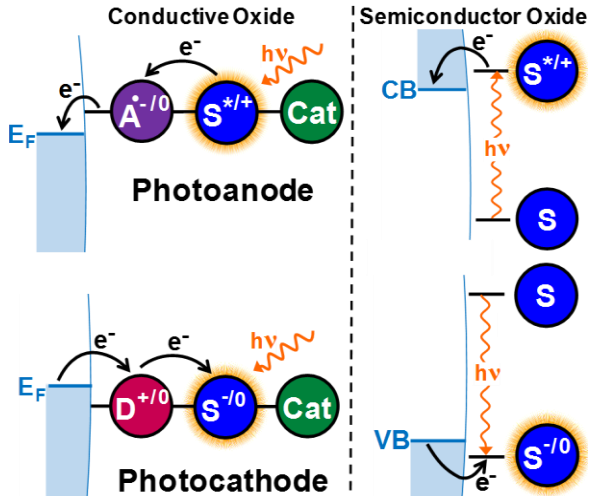
Harness **molecule-material interfaces** for the synthesis of solar fuels, with an emphasis on the **fundamental energy science underpinning photocatalytically active materials**. We seek to understand how molecular catalysts and chromophores can be integrated covalently and non-covalently with oxide materials to achieve structurally well-defined photoelectrodes that efficiently couple light absorption with multi-electron fuel-forming reactions.

RESEARCH GOALS:

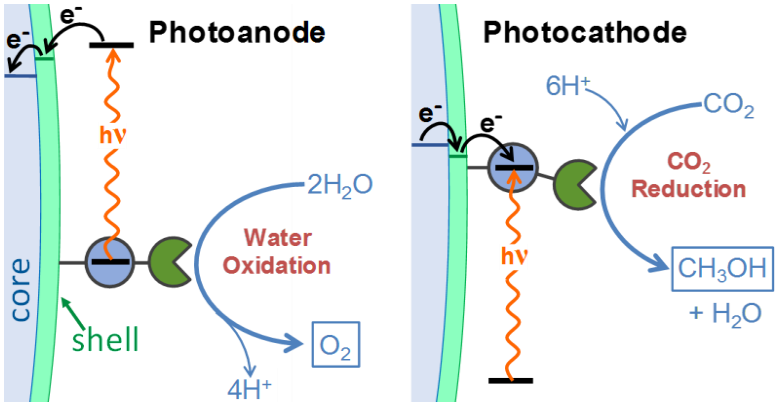
1. **Interface Highly Conductive Oxides with Molecular Light-harvesting Dyes and Photocatalysts.**
   Highly doped transparent conductive oxide (TCO) nanocrystalline mesoporous thin films will be utilized for dye-sensitized solar fuel generation. We will achieve molecular control of interfacial dynamics and catalysis at conductive oxides by determining reorganization energies and reduction potentials associated with electron transfer.

2. **Direct Multi-electron Flow at Photocatalytic Semiconductor Electrodes.**
   By controlling the structure of molecule-material interfaces, and by tuning electronic and protonic coupling at interfaces, we will identify and understand the basic principles that direct multi-electron flow between dyes, catalysts, and semiconductor oxides.

Research partners at UNC, University of Texas at San Antonio, and Georgia Tech



Dye-sensitized conductive (left) and semiconducting (right) oxide photoelectrodes.



Desired flow of electrons and protons at dye-sensitized semiconductor interfaces

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