Introduction to Exploratory Projects

In addition to deep research into high-risk, high-impact fundamental science and technology, GCEP also funds smaller exploratory efforts. These exploratory projects can be funded for up to one year, and have budget limits of up to $100,000 each. The goal of these projects is to quickly evaluate the feasibility of a novel concept. If such an investigation proves successful, the investigators may apply for regular GCEP funding.

Nine exploratory projects will be completed this year, while two additional exploratory efforts were underway in 2009 and are ongoing through 2010.

Professors Prinz and Gur of Stanford University are studying carbon-ion conducting thin film membranes for efficient CO_2 separation. This project aims to design and develop new materials that transport carbon-ions as a prelude to selective membranes for electrochemical separation and capture of CO_2. Currently, there are no solids known for carbon-ion transport at meaningful rates and at practical temperatures. The materials focus of this project is on doped carbides and involves the search and development of appropriate synthesis processes for fabrication of carbide thin films, design of doping strategies that facilitate formation of ionically compensated defects in the carbide structure, and demonstration of selective carbon-ion transport through the membrane using an electrochemical cell arrangement.

Professors Clemens and Salleo have been investigating ion-beam assisted deposition (IBAD) of textured templates that can be used to make efficient crystalline-Si thin-film solar cells. The idea behind this approach is that ion beams can be used to selectively determine the crystal orientation of the deposited crystalline films. By means of this technique, one can grow a polycrystalline film with well-aligned grains and therefore “smoother” grain-to-grain interfaces. As a result, the charges generated within the light-absorbing thin-film would undergo much fewer recombination processes at the grain boundaries and the overall conversion efficiency of the photovoltaic cell would be substantially improved.