AMPED EFRC: Addressing DOE Grand Challenges, Transformative Opportunities & Basic Research Needs

AMPED SOLAR FUELS

DOE GRAND CHALLENGES

1. How do we control materials processes at the level of electrons?

By harnessing in situ molecular-level characterization of photocatalysis at conducting and semi-conducting nanocrystalline oxide interfaces to guide the design of photoelectrodes that drive electron transport and transfer to/from molecular sites that carry out selective catalytic solar fuel synthesis.

2. How do we design and perfect atom- and energy-efficient synthesis of revolutionary new forms of matter with tailored properties?

By interfacing mesoporous nano-structured oxide materials designed to translate charges along specific vectors to/from broad spectral solar light-harvesting molecules and synthetically-tailored molecular catalysts to achieve high kinetic specificity for the multi-electron, multi-proton processes of solar fuels production.

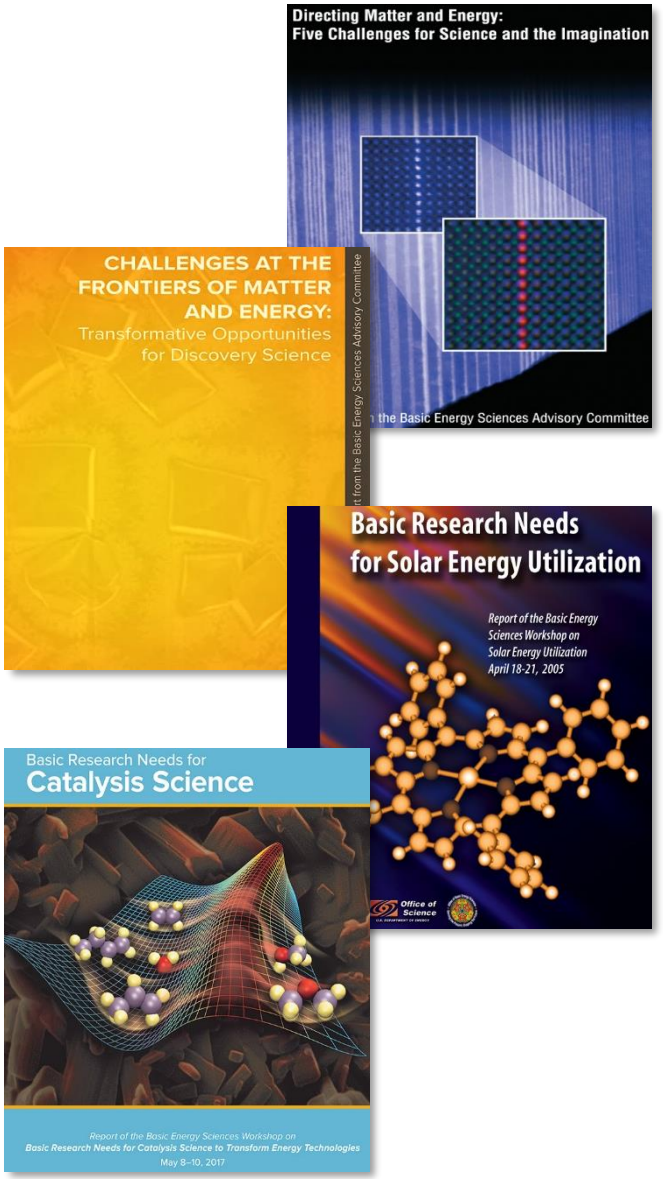
DOE TRANSFORMATIVE OPPORTUNITIES

Addressing the Transformative Opportunity "*Beyond Ideal Materials and Systems: Understanding the Critical Roles of Heterogeneity, Interfaces, and Disorder*" by quantifying the complex behaviors of structurally-disordered heterogeneous materials on a molecular level under realistic solar irradiance conditions across broad spatial and temporal scales through spectroscopic and electrochemical techniques.

DOE BASIC RESEARCH NEEDS REPORTS

AMPED EFRC research goals align directly with:

- 2005 BESAC BRN Report "*Basic Research Needs for Solar Energy Utilization*" by developing molecular catalysts and chromophores, and integrating these molecular components covalently and non-covalently with oxide materials to achieve structurally well-defined photoelectrodes that efficiently convert separated charges into chemical fuels.
- 2017 BESAC BRN Report "*Catalysis Science*" by providing a deep mechanistic understanding of catalytic transformations through discovery of new energy-storing chemistry at molecule-material interfaces.



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