

## **Advanced Materials Development for Energy Applications**

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Development of alternate, efficient and environmentally benign technologies for energy generation, conversion, transmission, storage and use is an intense area of research. At the University of Houston, several advanced materials such as superconductors, photovoltaics and thermoelectrics are being developed for energy applications. Superconducting tapes provide benefits of resistanceless transmission of electricity, ultra-high power densities, and rapid response to power surges in the electric grid. The challenge has been in developing these brittle ceramic materials in lengths of over a kilometer on flexible substrates with properties similar to that of high quality epitaxial thin films. Novel materials processing has been developed to fabricate superconducting tapes with excellent critical current performance by manipulation of grain orientations and nanoscale defects. Some of these novel approaches are being translated to photovoltaic materials with a goal of achieving high efficiencies that have been possible only on very expensive single crystalline substrates. III-V compound semiconductors on inexpensive, polycrystalline metal substrates are being investigated. Bulk materials are also being developed for thermoelectric applications for efficient power generation from waste heat. In this case, our objective is to achieve grain oriented oxide thermoelectrics with nanoscale defects so as to attain high figure of merit through combination of high electrical conductivity and low thermal conductivity. An overview of recent progress in advanced materials development for energy applications will be provided in this presentation.