

AFRL CALL FOR RESEARCH

1. **Research Title:** *Solid Oxide Fuel Cells for Mobile Applications*

2. **Individual Sponsor:** Dr. Ryan M. Miller
AFRL/RQPS, Bldg 18
1950 Fifth Street
WPAFB, OH 45433
ryan.miller@wpafb.af.mil

3. **Academic Area/Field and Education Level:** Chemical and Materials Engineering / electrochemistry, catalysis, ceramic processing, high-temperature materials, modeling/simulation (MS or Ph.D. level)

4. **Objectives:** Because of their high efficiency and low signatures, fuel cells are a highly promising power system technology which could enable long endurance, military-critical missions. Furthermore, because they have few moving parts, the projected costs of maintaining these systems are expected to be far less than internal combustion engines. The Department of Energy has been investigating these technologies for domestic applications but the emphasis of these approaches is on achieving low cost, high duty power units for centralized power generation. The performance requirements of defense applications, by contrast, are significantly more demanding mandating the research and development of high performance fuel cell systems. The objective of this effort is to explore materials and technologies for significantly improving the performance of fuel cell technology for defense related applications.

5. **Description:** The goal of this 3-year DAGSI project is to investigate methods for significantly increasing the power density and military fuel compatibility of solid oxide fuel cells (SOFCs). The Air Force Research Laboratory is actively developing alternative anode formulations which increase the tolerance of the anode to sulfur species contained in the fuel or fuel reformat. DAGSI researchers will assist AFRL in examining alternate anode materials which display sulfur tolerance and work to incorporate these into SOFCs capable of operation on sulfur containing JP-8 reformat. Computational examination of the mechanisms enabling sulfur tolerance in these materials is also desired. The Air Force Research Laboratory is also exploring alternate SOFC construction methods based on direct-write deposition processes to promote repeatability and to enable exploration of graded electrode interfaces. DAGSI researchers will work with AFRL to investigate SOFC fabrication processes through experiment or modeling/simulation approaches in order to explore alternative material combinations and fabrication conditions to produce high performing, power dense SOFCs. DAGSI Scholars are sought in the areas of electro/heterogeneous catalysis, ion/electron conductors, interfacial science, and metal-ceramic structures for high temperature ceramic-based fuel cells.

6. **Research Classification/Restrictions:** U.S. Citizens only.

7. **Interest in Summer USAFA Cadet:** NO

8. **Eligible Research Institutions:**

Universities (DAGSI) AFIT USAFA