RQ20-48

1. **Research Title:** *The Properties and Effects of Curing Conditions on Fiber Reinforced Potassium Geopolymer Matrix Composite*
2. **Individual Sponsor:**

Capt Steffan Wilcox, AFRL/RQHV
AFRL/RQHV Bldg 18
1950 Fifth St
WPAFB, OH 45433-7251
steffan.wilcox.1@us.af.mil

3. **Academic Area/Field and Education Level**
   Materials Science, Mechanical Engineering (MS or Ph.D. level)
4. **Objectives:** The objective of the proposed thesis topic is to develop and evaluate the effect of: 1) curing conditions (temperature, humidity, time) or 2) silica to alumina ratios on 0/90 SiC or carbon fiber-reinforced potassium geopolymer matrix composite. The goal of which is reducing dehydration damage and understanding the behavior of the composite when then exposed to load at elevated temperature. Testing in tension of composite samples at room and elevated temperatures to obtain strength and strain data is also an objective. Research will obtain microscopy, density, fiber volume, water loss and coefficient of thermal expansion of composite variants. Microscopy of specimens before and after exposure to evaluate damage and failure should be performed. An additional objective could include testing of monolithic geopolymer cement samples to isolate matrix properties. From this testing, conclusions regarding future composite research for this family of material should be determined.
5. **Description:** Geopolymer matrix composites have the potential to serve as a low cost substitute for CMCs, titanium and superalloys for structural aerospace applications in the 600-1000°C (~1100 – 1800 F) range. Geopolymers are alkali activated aluminosilicate inorganic polymer materials with ceramic-like properties. Reinforced with refractory/ceramic/carbon fibers, geopolymer matrix composites offer similar specific strengths to conventional CMCs which makes them theoretically suitable for elevated temperature structural components. Geopolymers have a relative ease of manufacture. They do not require multiple autoclave and infiltration cycles that CMCs require. They have the advantage of being fireproof and heat resistant to higher temperatures compared to high performance organic composites.
6. **Research Classification/Restrictions:** U.S. Citizens only. Most aspects of this research fall under the 6.1 basic research classification.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided

   DAGSI (Wright State University, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati) NOTE: Topics submitted to DAGSI must be approved for public release.

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