

Attachment 1 – DAGSI Research Topic

NOTE: Under the Cooperative Agreement, Technical Directorates have three options for topics. First, a topic can strictly be considered in the pool for the state allocation of funding. DAGSI will work across the TDs for this allocation. Second, the TD can be prepared to be a funding partner with the State of Ohio. This would include: providing additional funds to support additional recipients of a topic, or expand the proposers team to include additional members on a topic. Third, the TD may elect to fully fund a topic not selected for State of Ohio funding or to pursue University teams outside the State of Ohio. Contact lindsay.kotouch.2@us.af.mil for questions.

1. **Research Title:** Advanced Temperature Measurement Methodologies for Oxidizing Refractory Materials

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Materials Science and Engineering, Mechanical Engineering, Aerospace Engineering, or relevant field (MS or PhD level)

4. **Objectives:** Explore, develop, and validate repeatable, credible methodologies to accurately determine the surface temperatures of refractory ceramics undergoing dynamic changes in emissivity and/or surface roughness during high-temperature testing.

5. **Description:**

High-temperature material testing, such as oxyacetylene torch evaluations, is critical for assessing the performance of refractory ceramics and metals under extreme operational conditions. However, accurately measuring the surface temperature of these materials remains a major challenge. Active oxidation causes dynamic shifts in emissivity, changes in surface roughness, and localized phase transitions (e.g., liquid oxide scale flow, active-to-passive transitions). Additionally, optical measurements are subjected to severe spectral contamination and flame reflection from the combustion environment. Discrepancies between various measurement techniques and instrumentation severely hinder reliable material performance assessment and the development of high-fidelity predictive models.

The objective of this research is to develop and validate repeatable, credible, and traceable methodologies for determining accurate surface temperatures of Ultra-High Temperature Ceramics (UHTCs), their composites, and/or metal alloys as their emissivity, surface geometry, and/or chemistries evolve. Proposals must explore robust approaches to account for these dynamic changes under severe thermal and chemical conditions. The ultimate goal is to establish a standardized framework—or significantly advance the current state-of-the-art—for accurate, dynamic temperature measurements of refractory materials.

Methodology may include combustion-filtered spectropyrometry (targeting narrow, non-interfering spectral windows), high-speed optical shuttering to isolate target radiance from flame reflection, multispectral imaging, or angle-resolved directional emissivity modeling. Investigators are encouraged to combine experimental validations with material modeling to predict and understand the evolution of surface chemistry and optical characteristics. Researchers may utilize combinations of diverse temperature measurement techniques for cross-validation.

6. **Research Classification/Restrictions:** Papers, presentations, and posters will need to go through Security and Policy review before submission.
7. **Eligible Research Institutions:** Any of the seventeen university members of the Ohio Department of Higher Education's Research Officer's Council (ROC) with graduate science and engineering programs.