

Research Topic (Thermochemistry, Hot Erosion)

1. **Research Title:** Thermochemistry of Gypsum-based sulfate corrosion on directionally solidified super-alloys used in turbine engine hot sections
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Materials Engineering/Chemical Engineering/Mechanical Engineering/
 Electrical Engineering (BS or MS)

4. **Objectives:** The student research associate, under the supervision of AFRL CCEL materials engineers, will be the lead agent collecting and analyzing the data related to hot erosion degradation of super alloys in turbine engines.
5. **Description:** The recent doctoral work performed by an AFIT student (Major Krisak) has demonstrated that the mineral CaSO_4 (Gypsum¹) is the probable causative agent behind the development of hot corrosion degradation of super alloys found in turbine engine hot sections during and after deployment in Southwest Asia. This work has identified numerous large gaps in the understanding of the kinetics of sulfate attack as well as the most basic thermochemistry of sulfate attack on super alloys. This lack of understanding has prevented the development of truly predictive models of sulfate attack on real metal alloys. The lack of robust predictive models has restricted the ability to use condition-based maintenance and replacement logistics as a substitute for time-based replacement. Enabling condition-based maintenance of turbine engine components has the potential to save hundreds of millions of dollars annually across all of DoD and federal aviation in general. This study would be a key program to making condition-based maintenance of turbine engine components possible.
6. **Research Classification/Restrictions:** Work performed at university campus as well as on/off site at WPAFB; some facets of work will be restricted to DoD and DoD contractors only.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided

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