

## REACTIONS IN THERMAL BARRIER COATINGS AND MULTI-MINERAL DUSTS IN A GAS TURBINE ENGINE DUST INGESTION TEST

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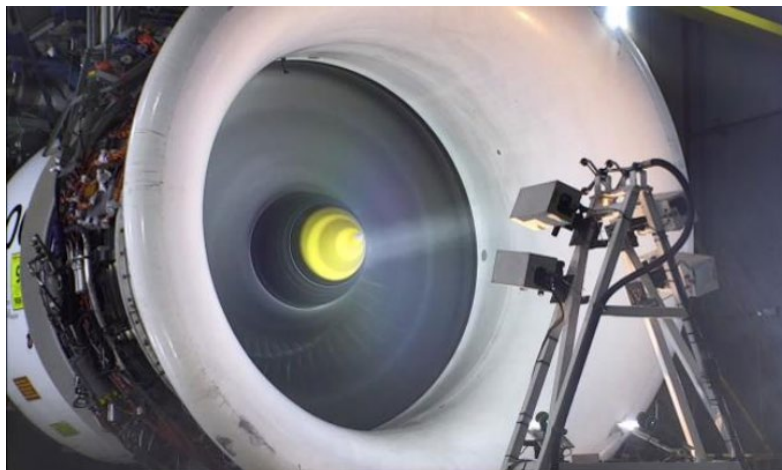
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The ingestion of complex multi-mineral dusts by gas turbine engines during service operations needs to be understood by engine manufacturers due to the potential for damage to protective thermal barrier coatings (TBCs), and the consequential impacts on component lifecycle cost. However, many of the existing studies in the literature relate to service engines that have operated under a range of conditions, and ingested dusts that vary in origin and mineral composition; this makes it difficult to identify and understand reactions that are occurring and link them to the component degradation observed.

Results are presented from a test bed engine that has been dosed with a dust of known mineral composition, designed to simulate operation in regions with evaporite rich geology, under controlled operating conditions [1]. Preliminary analysis of the hot-section components by Elms et al. [1] indicated that new phases formed in the deposits by reaction of minerals in the test dust; these were compared to previous analyses of service return engines. This study examines the interactions that occur between the mineral dust deposits and TBCs on hot section components, showing how the morphology of the deposits and the extent of reaction is influenced by component temperature. These observations are further explained through thermal exposure and melting studies performed with the test dust.



*Figure 1 – Rolls-Royce dust ingestion test set-up at engine inlet, showing dust delivery system.*

1. Elms, J., Pawley, A., Bojdo, N., Jones, M., and Clarkson, R. (2021) Formation of High-Temperature Minerals From an Evaporite-Rich Dust in Gas Turbine Engine Ingestion Tests. *J. Turbomach.* 143(6): 061003. <https://doi.org/10.1115/1.4050146>