CMAS CHALLENGES TO CMC-T/EBC SYSTEMS

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Gas turbine technology is undergoing a major transition with the recent implementation of SiC based ceramic composites (CMCs) in aircraft engines. While the potential improvement in temperature capability (≥1500°C) is unprecedented, there are a number of issues that limit the full exploitation of such potential. In addition to the longstanding concern for low temperature oxidative embrittlement and the limited temperature capability of current bond coats and matrices, the susceptibility of the protective SiO_2 to volatilization in the combustion environment requires the use of environmental barrier coatings (EBCs) to achieve durability targets. Most EBC concepts, however, are based on silicates and are thus susceptible to degradation by molten silicate deposits generically known as CMAS originating from mineral debris ingested into engines with the intake air. This presentation will discuss the thermodynamic and mechanistic foundation of the degradation of EBCs by CMAS, recent progress in establishing the relevant phase equilibria for these systems, and the role of the CMAS composition on the extent of degradation, as well as perspective on mitigation. (Research supported by ONR, AFOSR and the P&W Center of Excellence in Composites at UCSB.)