FACTORS AFFECTING CERAMIC ABRADABLE COATING DAMAGE ACCOMMODATION

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High temperature abradable coatings are based on thermal barrier coating compositions and play an integral role in not only providing thermal protection for turbine shrouds, but also in maintaining blade tip clearances for increased turbine efficiencies. As turbine material technologies advance, there is a push for the development of abradable coatings that can withstand more severe operating conditions and retain the optimum balance of abradability and durability. However, as abradable coating technologies are pushed to higher temperatures and greater capabilities, such as compatibility with ceramic matrix composites, there are significant challenges in understanding the underlying mechanisms that aid the design of these inherently brittle materials enabling them to accommodate damage in a controlled manner. This study will first discuss the theories for fracture mechanics and wear mechanisms in ceramics and how they can be related to abradable coatings. The influence of microstructural defects present in current technology ceramic abradable coatings on the preferred wear behavior of these systems will then be investigated. The coatings to be compared are air plasma sprayed dysprosia- or yttria- stabilized zirconia with varying fractions of pore former and secondary phases. The wear of both as-received and aged coatings will be tested, and deformation mechanisms will be reported. Links between different defects, their evolution with aging, and observed wear behavior will be compared with two competing definitions of desired abradable damage accommodation mechanisms, with one being energy dissipation through plastic deformation and the other depending on crack propagation and frictional sliding of the removed material to dissipate energy.