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PVD TBC EXPERIENCE ON GE AIRCRAFT ENGINES

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The higher performance levels of modern gas turbine engines present significant challenges in the reliability of materials in the turbine. The increased engine temperatures required to achieve the higher performance levels reduce the strength of the materials used in the turbine sections of the engine. Various forms of Thermal Barrier Coatings (TBCs) have been used for many years to increase the reliability of gas turbine engine components. Recent experience with the Physical Vapor Deposition (PVD) process using ceramic material has demonstrated success in extending the service life of turbine blades and nozzles. Engine test results of turbine components with a 125 um (0.005 in) PVD TBC have demonstrated component operating temperatures of 56-83 °C (100-150 °F) lower than uncoated components.

Engine testing has also revealed the TBC is susceptible to high angle particle impact damage. Sand particles and other engine debris impact the TBC surface at the leading edge of airfoils and fracture the PVD columns. As the impacting continues the TBC erodes away in local areas. Analysis of the eroded areas has shown a slight increase in temperature over a fully coated area, however, a significant temperature reduction was realized over an airfoil without any TBC.