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Thermal Barrier Coatings (TBC)

Thermal barrier coatings (TBCs) as the name suggests perform the important function of insulating components, such as gas turbine and aeroengine parts, operating at elevated temperature. Typical examples are turbine blades, combustor cans, ducting and nozzle guide vanes. TBCs have made possible the increase in operating temperature of gas turbines. TBCs are characterised by their very low thermal conductivity, the coating bearing a large temperature gradient when exposed to heat flow. The most commonly applied TBC material is Yttria Stabilized Zirconia (YSZ) which exhibits resistance to thermal shock and thermal fatigue up to 1150°C. YSZ is generally deposited by plasma spraying processes.

Anatomy of Coating

A typical Thermal barrier coating consists of four layers. They are the metal substrate, metallic bond coat, thermally grown oxide, and ceramic topcoat. The metal substrate and metallic bond coat are metal layers and the thermally grown oxide and topcoat are ceramic layers. The metal substrate is typically a high temperature nickel or cobalt alloy that is either in single crystal or polycrystalline form. Typically 5-12 other elements are added to the alloy depending on the requirement like fatigue, creep, high temperature strength etc. The metallic bond coat is an alloy typically with the composition of NiCoCrAlY.

The bond coat creates a bond between the ceramic coat and substrate. This layer is responsible for forming the thermally grown oxide, which is the third layer, when the TBC is subjected to high temperatures. The thermally grown oxide consists of alumina, and this layer protects the substrate from thermal oxidation and corrosion by serving as an oxygen diffusion barrier. Finally, the last coat is the ceramic topcoat. It is composed of Yttria Stabilized Zirconia (YSZ) which is desirable for having very low conductivity while remaining stable at nominal operating temperatures typically seen in applications. This layer creates the largest thermal gradient of the TBC and keeps the lower layers at a lower temperature than the surface.

Application Process:

Using state of art robotized plasma coating facility and skilled man power; the entire work shall be executed. The work execution will be under strict supervision and quality shall be monitored regularly. At important areas test coupons shall be made for future reference.

For more information please contact us or visit us at www.vtcsurftech.com.