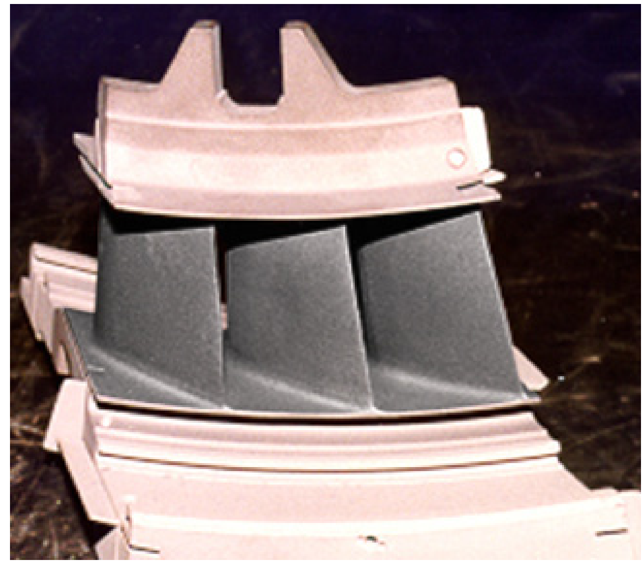
A10 aluminide coating



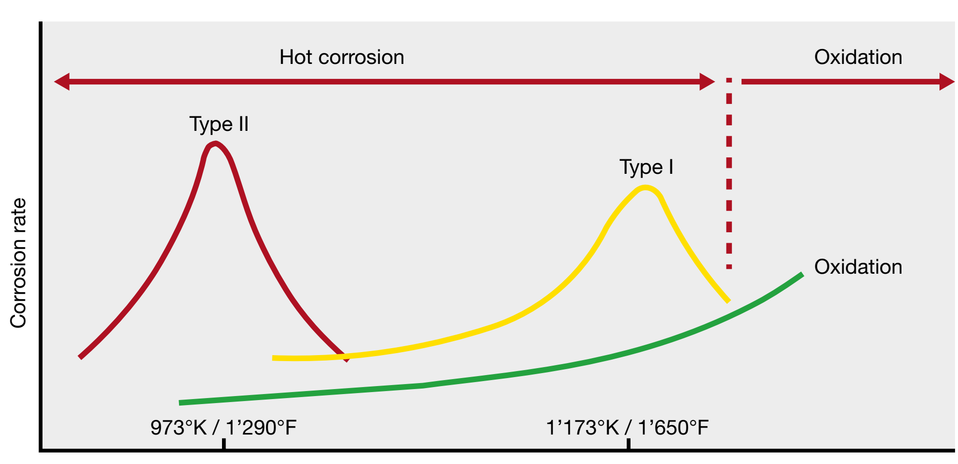
High temperature hot corrosion is of two types: type I and type II. Type I occurs above 1'650°F (900°C) and type II occurs between 1'200°F (650°C) to 1'470°F (800°C). In each of these types of hot corrosion a salt of some kind (e.g. Na_2SO_4) must be present, and the rate of metal degradation is much higher than other forms of corrosion.

Hot section components of gas turbines are exposed to very high temperatures, sometimes exceeding 2'400°F (1'315°C). These components are typically made of nickel and cobalt based alloys. Under conditions that include exposure to oxygen or sulphur at high temperature, severe oxidation and/or corrosion may occur. This degrades the material and shortens the useful life of the part.

For example, crude oils and residual-grade fuel oils typically contain small quantities of vanadium. During combustion, these fuels create ash deposits composed mainly of vanadium pentoxide [V2O5], with a low melting point of about 1'247°F (675°C). Thus, at typical gas turbine operating temperatures the vanadic ash deposits are molten, and thereby accelerate the surface oxidation rate of blades and vanes.

Distillate-grade fuels are often also contaminated with sodium. The presence of these alkali metal impurities [Na and K] leads to another type of high temperature corrosion known as sulfidation attack. In situations where both vanadium and sodium impurities are present, even lower melting point ash deposits can form and the risk of high temperature corrosion is further increased.

The comparative rates of oxidation and high temperature hot corrosion as a function of temperature.



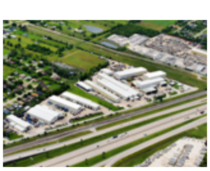
One solution widely practiced in the gas turbine industry is to modify the surface of the component with a readily oxidizable element. Aluminum is used because it forms a stable and adherent alumina (Al2O3) layer on the surface which protects the part from degradation.

A variety of coatings are based upon this protection scheme. One such coating, designated A10 by STSH, has been found to be useful in applications where resistance to high temperature oxida- tion and corrosion is required.

HICoat A10 is a silicon-modified aluminide coating that is similar to the SermaLoy® J or PWA 59 coatings. Coatings of A10 are applied as wet coatings using traditional air spray equipment and are cured in atmospheric furnace. Once the coated part is cured, the coating is diffused in a vacuum or retort furnace.

Diffusion temperatures will be a minimum of 1’625°F for nickel based alloys and a minimum of 1825°F for cobalt based alloys. Upon application and appropriate heat treating, the aluminides are formed by inward diffusion of aluminum. The diffusion layer thickness is typically .003 to .005 inch (75 to 125 microns).

HICoat A10 coatings may be utilized on both stationary and rotating components in the hot section of a gas turbine engine. A10 is routinely applied to both nickel and cobalt based alloys. Examples of parts which will benefit from A10 include turbine blades, vane segments, and nozzle segments which operate below 1’825°F. A10 can also be used as an over-aluminide over an HVOF MCrAlY.



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