HICoat A08/A21 corrosion resistant coatings

The Sulzer plus

- Corrosion resistant
  - No red rust after >3500 hours in salt fog testing
- Maximum efficiency
- Improved reliability

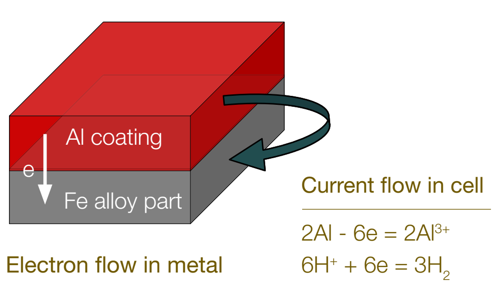


Figure 1: Cathodic protection
The diagram and reactions illustrate the electrochemistry of cathodic protection (sacrificial anode) of an aluminum coating on a steel part.

It has been shown that the surface finish of the airfoils can be satisfactorily restored by using suitable compressor coatings.

Recent developments in such coatings have been made to improve upon the corrosion/erosion resistance and to protect/restore the surface finish of the airfoils. The current generation of these coatings can withstand the more corrosive operating environments found in industrial gas turbines. An example of such a coating is shown in these pictures. This is an aluminum-filled metallic-ceramic coating made conductive via mechanical abrasive finishing. Conductivity of the coating results in sacrificiality, which is defined as the preferential corrosion of an active coating layer and the corresponding protection of a less active metal (see figure 1). The thickness of these coatings is typically between between 25-125 microns (1-5) mils). HICoat A08 and A21 are sealed using an inorganic sealer to enhance the corrosion resistance.

In the past 30 years, there have been three major types of coatings utilized to protect industrial gas turbine compressor airfoils from corrosion and/or erosion: metallic-ceramic, low temperature pack aluminide and diffused nickel cadmium coatings. The one coating used most predominantly today is the metallic-ceramic coating. This is due to its corrosion protection capabilities, versatility of use on large components, ability to restore surface finish, and cost of application.

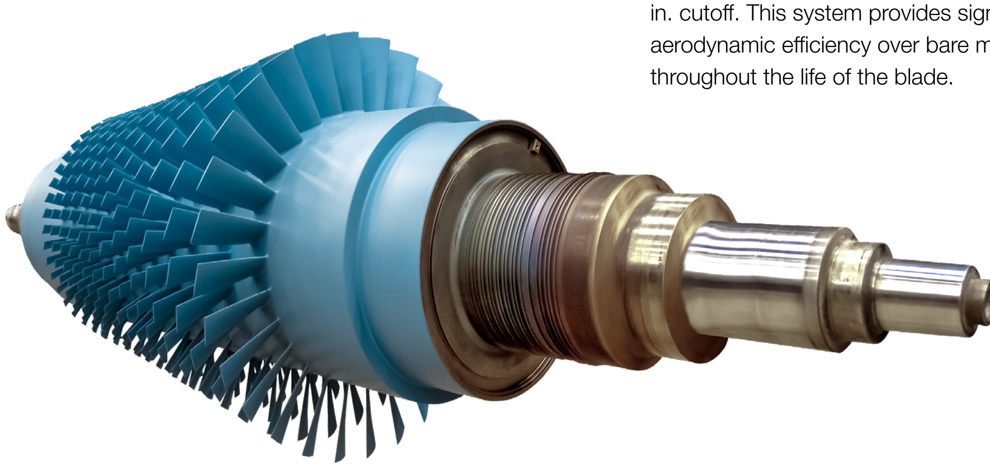
On compressor section airfoils (blades and vanes), a combination of heat, microscopic abrasives and a gradually increasing concentration of corrosive elements can ravage an initially smooth airfoil surface finish. Original Equipment Manufacturers (OEMs) specify the airfoils to have an initially smooth surface to obtain the maximum mass airflow through the turbine and to operate at the maximum compressor efficiency (typically 88-90% theoretical efficiency).

The principle of cathodic protection was illustrated by Sir Humphry Davy and Michael Faraday almost two centuries ago.

Typical coating thickness

	HICoat A08	HICoat A21
Average thickness	50 - 100 microns (2 - 4 mils)	75-125 microns (3-5 mils)
Surface roughness	< 40 Ra	< 40 Ra
Max. operating temperature	870°C (1,600°F)	870°C (1,600°F)
Coating adhesion (ATSM D2247)	Excellent - no pick off	Excellent - no pick off
Thermal shock, impact survival, solvent resistance	Excellent	Excellent

When two metals are electrically connected to each other in an electrolyte e.g. seawater, electrons will flow from the more active metal to the other, due to the difference in the electrical potential. When the most active metal (anode) supplies current, it will gradually dissolve into ions in the electrolyte, while producing electrons, which the least active (cathode) will receive through the metallic connection with the anode. As a result, the cathode will be negatively polarized and hence be protected against corrosion.



HICoat A08 and A21 are useful in most situations which require corrosion/erosion resistance and a smooth surface finish. Stationary and rotating compressor blading, diaphragms, guide vanes, and shrouds are some components which would benefit from this coating system. Although most alloys can be coated with HICoat A08 or A21, the material works especially well on ferrous alloys.

Average coating thickness of HICoat A08 is 50 - 100 microns (2 - 4 mils) and for A21 is 75-125 microns (3-5 mils). Roughness typically ranges between 10 to 40 Ra (µin) at 0.01 in. cutoff. This system provides significant improvements in aerodynamic efficiency over bare martensitic stainless steels throughout the life of the blade.

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How can we help you?
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