Specialized coatings for industrial turbines HICoat A08 – corrosion resistant coating

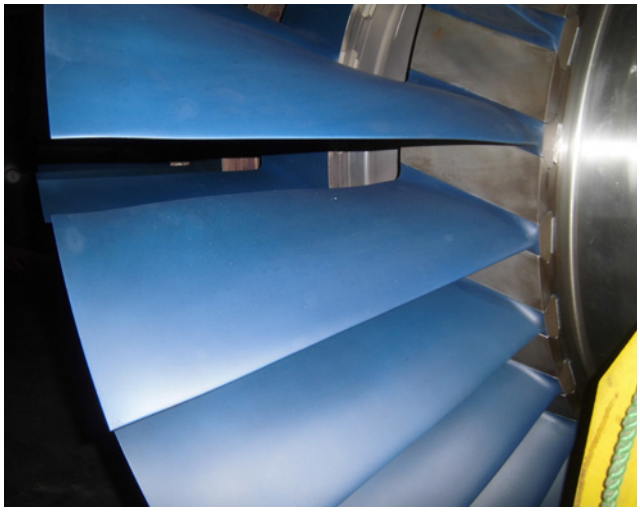
In the past 40 years, there have been three major types of coatings used to protect industrial gas turbine compressor airfoils from corrosion and/or erosion: metallic-ceramic, low-temperature pack aluminide, and diffused nickel cadmium coatings. By far, the one coating used predominantly today is the metallic-ceramic coating, due to its corrosion protection capabilities, versatility of use on large components, ability to restore surface finish, and cost of application.

Using suitable coatings to maximize airflow

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

Current-generation coatings resist more corrosion

There have been recent developments in such coatings to improve the corrosion/erosion resistance and to protect/restore the surface finish of the airfoils. These current-generation coatings are able to resist the more corrosive operating environments found in industrial gas turbines. An example of such a coating (designated HICoat A08 Sulzer) is shown here. This shows an aluminum-filled metallic coating made conductive via a mechanical abrasive finishing. The conductivity of the coating results in sacrificial preferential corrosion of an active coating layer and the corresponding protection of a less active metal. The thickness of these coatings is typically between 1-3 mils (25-75 microns).



- Innovative
- Extended lifetime
- Cost effective

HICoat A08 to enhance corrosion resistance

HICoatA08 is sealed using an inorganic sealer to enhance the corrosion resistance. The aluminum in the base coat prevents corrosion by acting as a sacrificial coating on ferrous substrates. HICoat A08 is useful in most situations that require corrosion/ erosion resistance and a fine surface finish. Stationary and rotating compressor blading, diaphragms, guide vanes, and shrouds are all components that would benefit from this coating system. Although most alloys can be coated with HICoat A08, the material works especially well on ferrous alloys.

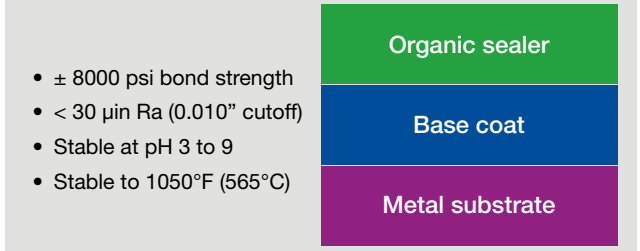
Variable thickness for variable needs

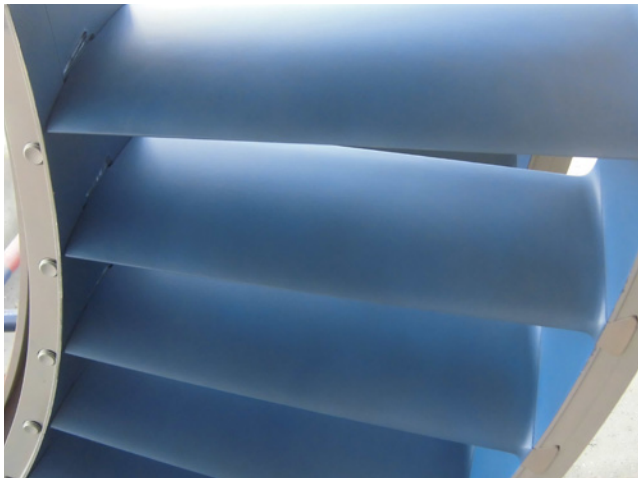
The average recommended thickness is 1-3 mils (25-75 microns) for most applications. However, the coating can be applied much more thinly or thickly if necessary. Roughness typically ranges between 10 to 30 Ra (µin) at 0.01 inch (0.25 mm) in cutoff on new industrial gas turbine gas path surfaces. This system provides significant improvements in aerodynamic efficiency over bare martensitic stainless steels throughout the life of the blades and components.

The cathodic corrosion protection

The principle of cathodic protection was discovered by Sir Humphry Davy and Michael Faraday almost two centuries ago. 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, and at the same time produce electrons, which the least active (cathode) will receive through the metallic connection with the anode. The result is that the cathode will be negatively polarized and, hence, be protected against corrosion.

- ± 8000 psi bond strength
- < 30 µin Ra (0.010” cutoff)
- Stable at pH 3 to 9
- Stable to 1050°F (565°C)





Rotating turbine blades with HICoat A08

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