STEAM TURBINE COATINGS

By Scott MacFarlane

Industrial steam turbines are susceptible to corrosion, erosion and deposit build-ups on almost all components of the turbine where steam is present. These problems may occur throughout the entirety of the turbine in both condensing and noncondensing steam turbines so no one machine is safe. Since these problems can lead to failures and expensive replacement parts, coating the turbine components can be a cost effective prevention measure. Several coating methods and materials have been tested to reduce the amount of damage on the turbines, although damage prevention isn't the only reason to coat turbines. Coatings can be used for material build-up and clearance control to improve efficiency and provide a sacrificial protection again rubs.

Coatings for damage prevention are usually applied after a rotors campaign to determine the appropriate type of coating for the environment the machine is facing. For example, if the blades of a rotor are subjected to corrosive conditions, a certain coating would be used to help recover the blades and to extend the blades' life cycle. If the blades are encountering heavy erosion, another coating can be used as a sacrificial layer of material to slow down the effects of erosion on the blades. Finally, if the blades have an excess of deposits on the airfoils, an alternative coating can be used to reduce the amount of contaminants that stick to the blades.

There are several coating options to choose from based on the turbines specific needs, but a few main types of coatings used in the steam turbine industry for damage prevention include a Titanium nitride (TiN), an Electroless nickel (EN), a Tungsten carbide (WC) and a metallic slurry coating. These coatings have been tested and proven to be more efficient in terms of build-up resistance, erosion resistance and extending the lifecycle of rotor components when compared to base materials.

The application and adhesive properties of these coatings varies based on material and thickness required. Common industry application processes include bath dipping, plasma spray, and high velocity oxygen fuel (HVOF). Bath dipped coatings such as Electroless nickel allows the coating to reach areas that cannot be accessed through line of site for spraying processes. Plasma spray is more versatile as it is capable of spraying a wider range of materials while HVOF can produce a superior quality coating and greater adhesion to the base material. The application process to use is based on the type of coating, the turbines' specific needs, the turbines mechanical properties and the turbines' operating conditions.

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