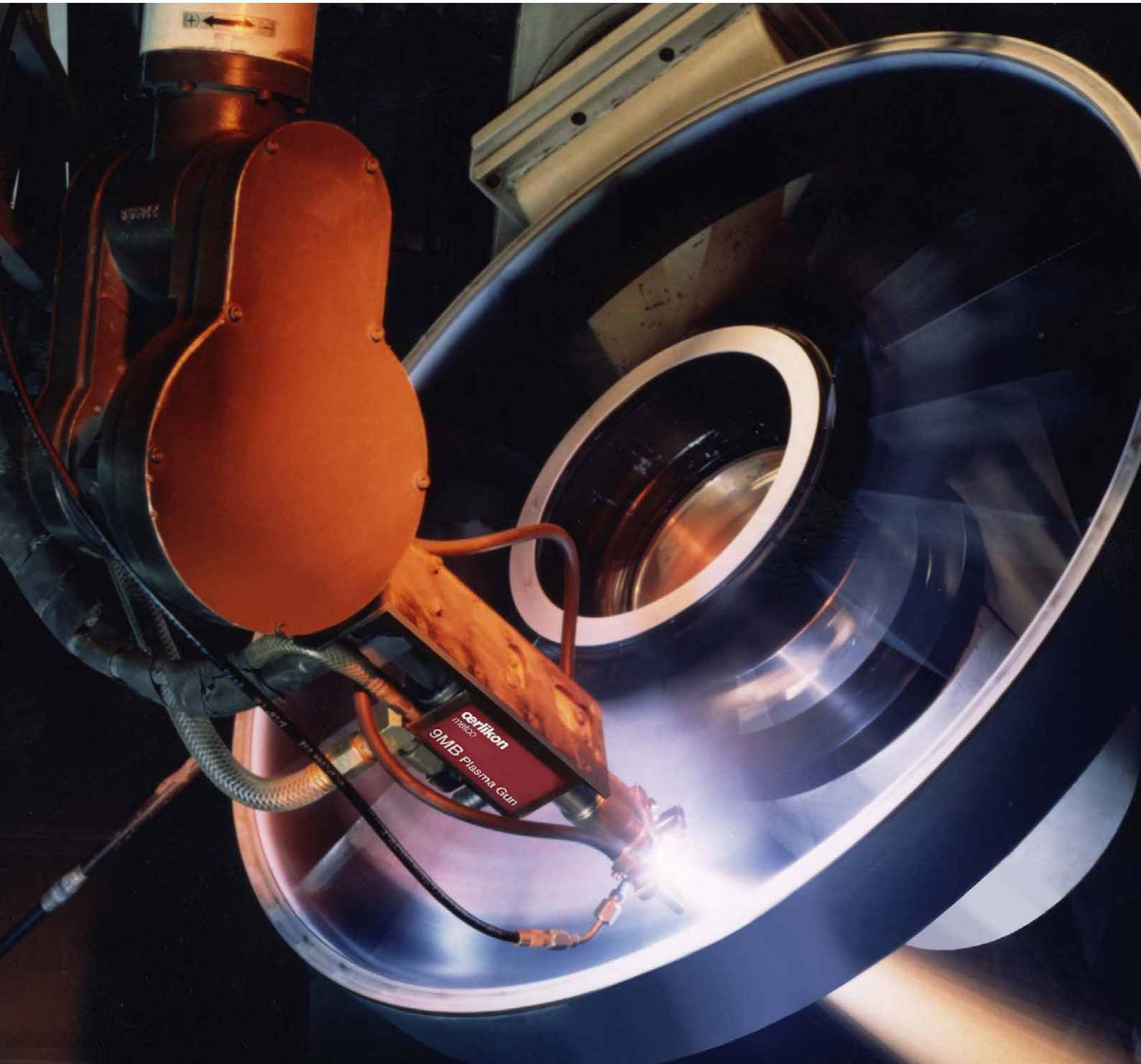


Solutions Flash

Tungsten-lined 9MB and 3MB gun nozzles improve reliability and optimize plasma spray production

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Today's situation

The conditions under which the components of a plasma spray gun must operate is, without question, one of the toughest ever devised. The combination of extremely high temperatures, gases flowing at high speeds and a very strong electric arc combine to rapidly erode and gouge the nozzle that acts as the anode within the gun.

Out of necessity, plasma gun nozzles are made of copper. The copper nozzle, having excellent electrical properties, also takes advantage of copper's superior thermal conductivity, as it is the gun cooling water, constantly flowing on the outer surfaces of the nozzle, that allows plasma spray to be a viable coating process, at all. Finally, copper is cost effective, so the periodic replacement of the copper nozzle contributes only a minor percentage of the overall cost of plasma spray production.

The Oerlikon Metco solution

Users of Oerlikon Metco's F4 and TriplexPro™ series plasma spray guns enjoy the additional advantages of a nozzle that is lined with tungsten. The tungsten provides a wear resistant surface against erosion, significantly increasing nozzle longevity and virtually eliminating the potential for copper spitting.

However, users of the Oerlikon Metco 3MB and 9MB plasma spray guns have not had this option available. Now, Oerlikon Metco has developed optional tungsten-lined nozzles for these very popular plasma spray guns.

Nonetheless, with all of copper's advantages, it is a relatively soft metal. As the copper nozzle erodes, the plasma process drifts. Modern plasma spray controllers can help maintain the spray window within acceptable limits for a period of time, but eventually, those limits are exceeded.

For customers with tightly controlled process windows and customers operating the spray gun at higher energy levels, the life of the copper nozzle is a limiting factor in their coating production.

Furthermore, as this erosion occurs, small particles of copper may become entrapped in the coating. For some coating applications, this copper 'spitting' has catastrophic consequences on coating quality.



Solution Description and Validation

Elimination of copper spitting

While copper spitting is never desirable, for some coating applications, any level of copper inclusion in the coating is cause for coating rejection. This is certainly true for certain ceramic applications, such as biomedical applications, anilox rolls and corona rolls.

The cause of the copper spitting from a plasma nozzle is the result of the strong arc attachment from the electrode to the nozzle. During gun operation, the surface of the nozzle at the area of arc attachment will become increasingly roughened. Eventually, small bits of copper are broken off the nozzle, melt and become entrained in the coating.

As tungsten is a much more wear resistant material than copper, the use of tungsten linings significantly slows the nozzle wear and eliminates copper spitting.



Left: Standard nozzle. Right: Tungsten-lined nozzle.

Reduction of process drift

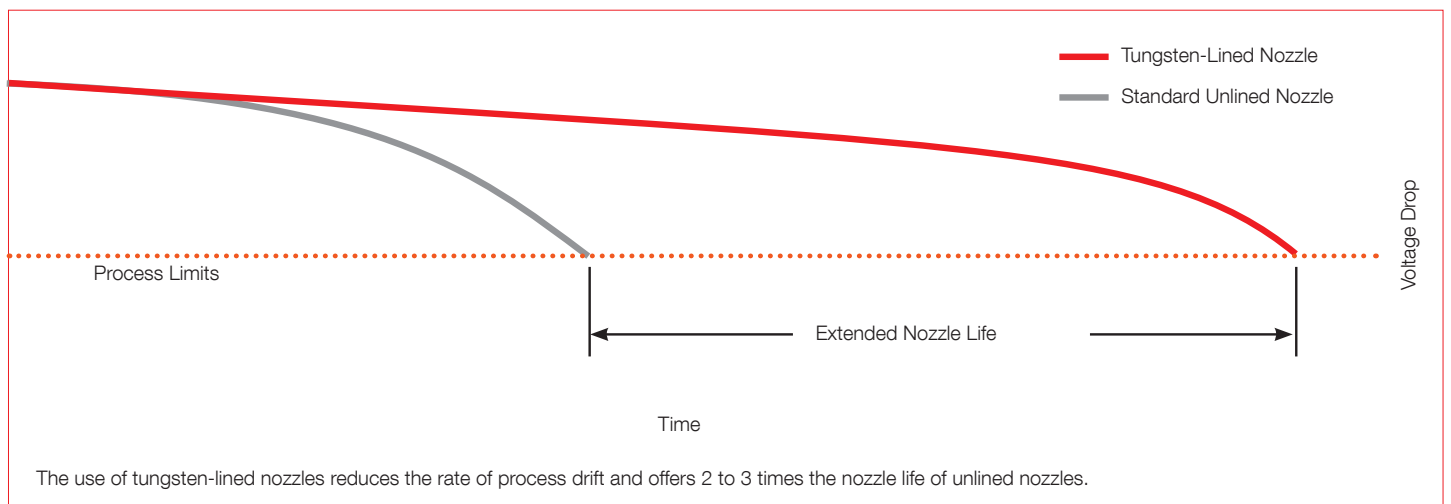
Processing of critical components often requires tightly controlled spray process windows. Tungsten, being a refractory metal, has a much higher hardness and melting point than copper. A tungsten lined nozzle, therefore, offers better resistance to the high temperatures of the plasma gun, and higher wear resistance to the plasma arc and process gases. The use of tungsten-lined nozzles will help control process drift for extended periods compared to nozzles without tungsten linings.

Longer nozzle life

Customers have reported 2 to 3 times the nozzle life using tungsten-lined nozzles versus unlined nozzles, even for applications with tight processing windows. While all customers should expect to see longer life using the tungsten-lined nozzles, nozzle life is difficult to predict and is dependent on many factors, including:

- Plasma gun power levels
- Plasma process gases used
- Cooling water quality
- Average run time between plasma gun starts and stops
- Spray processing tolerances

For very aggressive spray parameters, tungsten-lined nozzles may be the determining factor that allows a spray campaign to be completed without intermediate gun maintenance.



Customer benefits

Effective

- Eliminates copper spitting, reducing rejection rates, particularly for applications with zero tolerance for copper in the coating.
- Reduces the rate of spray process drift

Economical

- Provides 2 to 3 times the nozzle life and reduces gun maintenance.

Tungsten-lined nozzles are available in all nozzle diameters for the Oerlikon Metco 9MB, 3MB and 3MBTD plasma spray guns. Please ask your Oerlikon Metco account representative for more information.

Efficient

- For highly aggressive spray parameters, allows completion of spray campaigns without intermediate gun maintenance.
- Improves spray run consistency.
No adjustment of spray parameters are required.

Environmental

- Fewer nozzle changeovers reduces waste.