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Metal infusion surface treatment extends life of die casting equipment

A new surface treatment developed by C3 International LLC, Alpharetta, Ga., with ITP support by Oak Ridge National Laboratory (ORNL), Oak Ridge, Tenn., is increasing the lifetime and productivity of engineering components in a variety of industrial applications. Metal infusion surface treatment (MIST) uses rapid infrared processing to infuse up to 57 elements into the surface of metals, alloys, and other inorganic materials, and then secures these elements with a thin, nanostructured surface treatment.

Scientists from C3 International discovered a means of bonding its surface treatment to a substrate, overcoming the spalling and flaking problems commonly experienced using conventional coatings, using rapid infrared processing and other heating methods. This method was proven and optimized with the assistance of an Industrial Technologies Program (ITP) Metals Processing Laboratory Users (MPLUS) facility project at ORNL. The treatment was applied to parts used in aluminum die casting. The treatment improved the life of die casting components as



Untreated and treated H 13 tool steel die pins after 3,500 and 200,000 shots of aluminum, respectively.



Thermocouple sheaths after exposure to molten aluminum; probe at bottom shows condition of untreated probe after 91 cycles.



MIST-coated probe after 467 cycles. In dip tests in molten aluminum at a temperature of 760°C, life of z-MIST treated 1010 steel thermocouple sheaths reportedly had eight times longer service life than that of untreated sheaths.

much as 50 times, and produced inserts that led to the doubling of spindle speeds with no reduction in tool life.

To better understand how the rapid infrared heating process works, x-ray diffraction (XRD) and scanning auger microanalysis (SAM) were used at ORNL's High Temperature Materials Laboratory (HTML) to characterize the treatments in a project sponsored by the FreedomCar and Vehicle Technologies Program.

As a result of these investigations, C3's patents were extended to include treatment of aluminum die casts and accessories. Metalworking tools and catalytic devices and other inorganic materials have also been treated resulting in increased lifetimes and performance.

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