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Thermal Spray Improves Performance in Transportation Applications

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Replacing Chromium Plating with Environmentally Friendly Composite Coatings

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Harmful coating materials like cadmium, chromates, and carbides are heavily used in aerospace applications for corrosion and wear protection even though the health related dangers associated with these coating materials and application processes is well documented. Recent changes in U.S. Federal acquisition and European Union coating regulations place significant restrictions on the purchase of components and systems treated using hexavalent chrome plating techniques and create a burgeoning demand for cost-effective, rapidly deployable alternatives. OEMs and MROs face challenges in qualifying alternative replacement coatings that provide similar characteristics of chrome coatings.

MesoCoat's PComP Solution

Over the past several years MesoCoat designed, manufactured, and tested a family of three unique PComP powders suited for use in aerospace applications. PComP thermal spray coating powders offer high corrosion and wear resistance, higher deposition rate, lower spallation, lower density, and require less finishing time than competing chrome and tungsten-carbide (WC) coating materials.

PComP nanocomposite thermal spray powders offer a combination of both toughness and hardness stemming from a patented coating microstructure that combines high hardness zones of a ductile metal in an optimum geometry. PComP-S coating materials made using lightweight, low cost silicon-based reinforcements for aerospace applications is 70% lighter than WC coatings and 40% lighter than the hard chrome alternative it was designed to replace due to the use of lightweight, low cost silicon-based reinforcements. Initial test results shows the coatings can be machined 3 to 5 times faster than carbides using just SiC (and potentially alumina wheels) instead of expensive diamond wheels. PComP combines high hardness cermet cores with microscale ductile metal features to produce coatings with exceptional properties.

PComP-S is equal to or better than both WC and chrome coatings products in nearly all characteristics as shown in Fig 2. PComP-S has significantly improved corrosion resistance, coefficient of friction, and sliding wear resistance, as well as ductility similar to that of hard chrome. This nanostructured nitride-based coating was initially designed specifically for aerospace air frames and landing gear but was soon found to be applicable to many aircraft parts. The density of these coatings is less than half of WC. The reduced weight results in lower fuel consumption and associated greenhouse gas emissions. Although the coating is similar in hardness to hard chrome plating, it provides improved toughness and better corrosion resistance than chrome. Residual stress is an important coating characteristic, since it can reduce fatigue life; a very important consideration in parts where the primary failure mode is fatigue, such as landing gear. Because the PComP coatings have increased ductility, they pass the fatigue screening tests even if the residual stress of the coating is in tension. Another property of both PComP-T and PComP–S (titanium nitride and silicon nitride) is their microstructure letting them function as solid lubricants, for enhanced wear resistance. For example, the coefficient of friction for PCompP-T is only 0.03, compared to 0.11 for chromium carbide, resulting in longer life for components.

Each PComP product was designed to meet specific property needs of aircraft parts and equipment in other industries. PComP-W, designed to replace tungsten carbide, is one of the toughest, hardest coating materials on the market with high resistance to spalling. PComP-S was designed for use in high-stress application, and PComP-T for low to medium stress chrome-replacement applications. All PComP products are currently undergoing field testing and qualification in the

Fig. 1 — *PComP coatings are a direct replacement for chromium plating currently used to protect landing gear from corrosion and wear.*

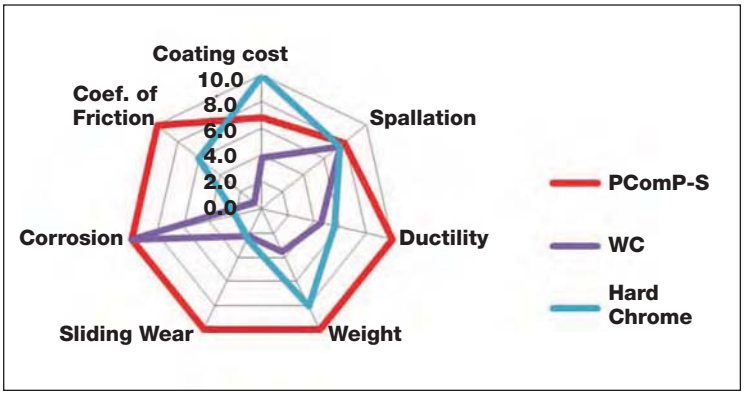

Fig. 2 — *PComP coatings applied to rotors, rods, pistons, actuators, and airframe parts provide good protection at a lower life-cycle cost.*

Fig. 3 — *PComP-S coating is equal to or better than both WC and chromium plating products in nearly every characteristic.*

aerospace, oil and gas, mining, and chemical processing industries. The preliminary results for landing gear are excellent with respect to corrosion, wear, spallation, and fatigue. PComP-S and PComP-W passed fatigue and spallation tests with exceptional results. In a recent test at University of Dayton Research Institute, Ohio, PComP samples surpassed 230 ksi of combined load of compression and tension compared to 180 ksi for commercially available tungsten carbide.

PComP is a trademark of MesoCoat.

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