Improved Small-Particle Powders for Plasma Spraying

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Improved small-particle powders and powder-processing conditions have been developed for use in plasma spray deposition of thermal-barrier and environmental-barrier coatings. Heretofore, plasma-sprayed coatings have typically ranged in thickness from 125 to 1,800 µm. As explained below, the improved powders make it possible to ensure complete coverage of substrates at unprecedentedly small thicknesses — of the order of 25 µm.

Plasma spraying involves feeding a powder into a hot, high-velocity plasma jet. The individual powder particles melt in the plasma jet as they are propelled towards a substrate, upon which they splat to build up a coating. In some cases, multiple coating layers are required. The size range of the powder particles necessarily dictates the minimum thickness of a coating layer needed to obtain uniform or complete coverage. Heretofore, powder particle sizes have typically ranged from 40 to 70 µm; as a result, the minimum thickness of a coating layer for complete coverage has been about 75 µm.

In some applications, thinner coatings or thinner coating layers are desirable. In principle, one can reduce the minimum complete-coverage thickness of a layer by using smaller powder particles. However, until now, when powder particle sizes have been reduced, the powders have exhibited a tendency to cake, clogging powder-feeder mechanisms and feed lines.

Hence, the main problem is one of synthesizing smaller-particle powders having desirable flow properties. The problem is solved by use of a process that begins with a spray-drying subprocess to produce spherical powder particles having diameters of <30 µm. (Spherical-particle powders have the best flow properties.) The powder is then passed several times through a commercial sifter with a mesh to separate particles having diameters <15 µm. The resulting fine, flowable powder is passed through a commercial fluidized-bed powder feeder into a plasma spray jet.

This work was done by Quynh Giao N. Nguyen and Robert A. Miller of Glenn Research Center and George W. Leissler of QSS Group, Inc. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17433-1.

Bonding-Compatible Corrosion Inhibitor for Rinsing Metals

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A corrosion-inhibiting mixture of compounds has been developed for addition to the water used to rinse metal parts that have been cleaned with aqueous solutions in preparation for adhesive bonding of the metals to rubber and rubberlike materials. Prior to the development of this corrosion inhibitor, the parts (made, variously, of D6AC steel and 7075-T73 aluminum) were rinsed by deionized water, which caused corrosion; unfortunately, because of

Promises among the needs to inhibit corrosion of steel, inhibit corrosion of aluminum, and minimize cosmetic staining of both steel and aluminum. Concentrations of sodium silicate in excess of 150 parts of silicon per million parts of solution (ppm Si) have been determined to enhance inhibition of corrosion; unfortunately, because of

In a Blind Hole in a D6AC Steel Specimen washed with deionized water, corrosion products can be seen on the thread (a). There is no visible sign of corrosion in a similar specimen rinsed with the corrosion-inhibited solution (b).