Materials

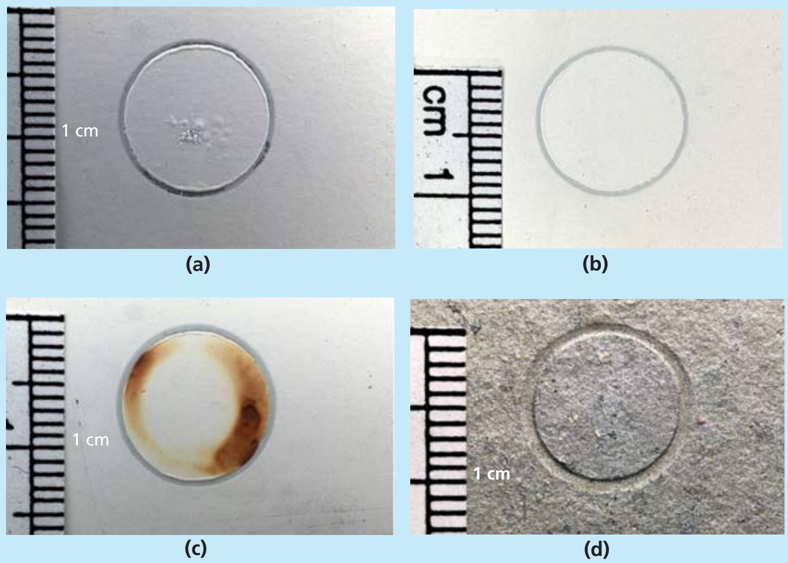
Corrosion-Prevention Capabilities of a Water-Borne, Silicone-Based, Primerless Coating

Some formulations are better for steel, some for aluminum.

John F. Kennedy Space Center, Florida

Comparative tests have been performed to evaluate the corrosion-prevention capabilities of an experimental paint of the type described in "Water-Borne, Silicone-Based, Primerless Paints," *NASA Tech Briefs,* Vol. 26, No. 11 (November 2002), page 30. To recapitulate: these paints contain relatively small amounts of volatile organic solvents and were developed as substitutes for traditional anticorrosion paints that contain large amounts of such solvents. An additional desirable feature of these paints is that they can be applied without need for prior application of primers to ensure adhesion.

The test specimens included panels of cold-rolled steel, stainless steel 316, and aluminum 2024-T3. Some panels of each of these alloys were left bare and some were coated with the experimental water-borne, silicone-based, primerless paint. In addition, some panels of aluminum 2024-T3 and some panels of a fourth alloy (stainless steel 304) were coated with a commercial solvent-borne paint containing aluminum and zinc flakes in a nitrile rubber matrix. In the tests, the specimens were immersed in an aerated 3.5-weight-percent aqueous solution of NaCl for 168 hours. At intervals of 24 hours, the specimens were characterized by electrochemical impedance spectroscopy (EIS) and measurements of corrosion potentials. The specimens were also observed visually.



Blistering of an Experimental Silicone Paint is manifest on two alloy specimens after immersion for a week in an aerated saltwater solution: (a) silicone-coated aluminum 2024-T3 panel, (b) silicone-coated 316 stainless-steel panel, (c) silicone-coated cold-rolled-steel panel, and (d) aluminum 2024-T3 panel coated with aluminum- and zinc-filled nitrile rubber.

As indicated by photographs of specimens taken after the 168-hour immersion (see figure), the experimental primerless silicone paint was effective in preventing corrosion of stainless steel 316, but failed to protect aluminum 2024-T3 and cold-rolled steel. The degree of failure was greater in the case of the cold-rolled steel. On the basis of visual observations, EIS, and corrosion-potential measurements, it was concluded that the commercial aluminum- and zinc-filled nitrile rubber coating affords superior corrosion protection to aluminum 2024-T3 and is somewhat less effective in protecting stainless steel 304.

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Sol-Gel Process for Making Pt-Ru Fuel-Cell Catalysts

Relative to another process, this one takes less time and yields better results.

NASA's Jet Propulsion Laboratory, Pasadena, California

A sol-gel process has been developed as a superior alternative to a prior process for making platinum-ruthenium alloy catalysts for electro-oxidation of methanol in fuel cells. The starting materials in the prior process are chloride salts of platinum and ruthenium. The process involves multiple steps, is time-consuming, and yields a Pt-Ru product that has relatively low specific surface area and contains some chloride residue. Low specific surface area translates to incomplete utilization of the catalytic activity that might otherwise be available, while chloride residue further reduces catalytic activity ("poisons" the catalyst). In contrast, the sol-gel process involves fewer steps and less time, does not leave chloride residue, and yields a product of greater specific area and, hence, greater catalytic activity.