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NASA TECH BRIEF

High-Emittance Coatings on Metal Substrates

An investigation has been conducted to find high-emittance coatings for application on substrates of the following metals: stainless steel, columbium–1 percent zirconium (Cb–1Zr), and beryllium. The purpose of these coatings is to promote and control radiative heat transfer from metal substrates, such as those comprising jet engine components or nuclear space power plant radiators. The more promising coatings were found to be the titanates of iron, calcium, and zirconium. These coatings exhibit emittances of 0.85 or greater in a vacuum of 10^{-6} torr (or higher) at elevated temperatures.

In addition, the coatings show good adherence to the substrate metals. There is also fairly good compatibility between the coatings and metal substrates. For example, tests have indicated that some oxygen, iron, and titanium diffuse into the Cb–1Zr from the iron titanate coating; however, the actual amount of diffusion is related to the time and temperature of exposure. These high-emittance coatings also provide some degree of chemical protection to the more reactive metal substrates. For example, in a sense the iron–titanate "corrodes" the Cb–1Zr alloy, since oxygen, iron, and titanium diffuse into it. This diffusion, however, actually strengthens the Cb–1Zr alloy to some degree.

Numerous high-emittance coatings were investigated. They were successfully applied by thermal (plasma arc) spraying, although electroplating and liquid binder application techniques were also investigated.

The adherence, compatibility, and emittance stability of the various coatings over a range of elevated temperatures and high vacuums were evaluated.

Note:

Complete details may be obtained from:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
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Patent status:

No patent action is contemplated by NASA.

Source: R. C. Emanuelson,
W. L. Luoma, and W. J. Walek
of Pratt & Whitney Aircraft Corporation
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