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DEVELOPMENT OF SILICIDE COATINGS FOR TANTALUM AND COLUMBIUM ALLOYS

In a coating development study for T-222 tantalum alloy, Solar has prepared and oxidation tested 17 silicide coatings consisting of various combinations of molybdenum, tungsten, titanium, vanadium, chromium, and silicon.(1) In Solar's two-step process, the surface is alloyed by applying a metallic slurry followed by vacuum sintering. Modified specimens are then silicided by pack cementation in argon. Application of the modifier alloy by pack cementation was found to be far less effective. The addition of titanium and vanadium to molybdenum and tungsten yielded beneficial modifier alloys, whereas the addition of chromium showed no improvement in oxidation resistance. After being silicided, TNV-7 (15Ti-35W-15V-35Mo + Si) exhibited the best performance. Samples survived up to 1064 hours in air at 2400 F and reproducibly demonstrated lives in excess of 600 hours both at 1600 and 2400 F during cyclic oxidation. Protection of both Cb-752 and D-43 alloys also was demonstrated.

DEVELOPMENT OF FLUIDIZED-BED TECHNIQUES FOR DEPOSITING COATINGS

Boeing has continued its work on the development of fluidized-bed techniques for applying protective coatings to refractory alloys.(2) The simple disilicide process was optimized in an 8-inch bed and scaled up to an 18-inch bed using statistically planned experiments to determine the effects of significant variables. The process was production proofed by coating C-129Y columbium alloy hardware. A process was developed for applying a vanadium-modified disilicide coating (25 to 35 mole percent VSi_2 being optimum) for C-129Y and F-10W alloys in a 4-inch fluidized bed which was then scaled up to processing in an 8-inch bed. The three-step process consisted of presiliciding, vanadizing, and post siliconizing. The resulting silicide coating on C-129Y alloy displayed a three-fold increase in cyclic-oxidation life at 2600 F as compared with the optimized simple disilicide coating. A two-step fluidized-bed process consisting of chromium-titanium codeposition and siliconizing was developed for applying the Cr-Ti-Si coating on Cb-752 and FS-85 alloys in a 4-inch bed; the cyclic-oxidation life of this coating at 2600 F (50 to 150 1-hour cycles) was comparable with that of the TRW Cr-Ti-Si pack-cementation coating and was superior to those of both simple and vanadium-modified disilicides.

NONDESTRUCTIVE EVALUATION

The feasibility of using back-emission electron radiographic techniques for the nondestructive inspection of surfaces has been demonstrated by the Air Force.(3) The technique has been used to detect failure sites in Cr-Ti-Si coated Cb-752 alloy and low- and high-density areas in silicide-coated Mo-TZM. At present, inspection can be made on sheets up to 10 x 12 inches in size.

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