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NASA TECH BRIEF

High Temperature Glass Coatings for Superalloys and Refractory Metals

A series of high melting temperature glasses can be used as protective coatings on selected superalloys and refractory metals used in high temperature environments. Such metals and alloys are highly susceptible to oxidation at high temperatures in oxidizing atmospheres, and require surface protection. Refractory metal surfaces have been coated with silicides, and superalloys with aluminides. Both coatings form a protective film by oxidizing in air and forming a thin, glassy, surface layer. Disadvantages of these coatings, however, are associated with the fact that the oxide surface layer becomes depleted and the silicon and aluminum diffuse into the substrate metal. Conventional all-glass coating systems (metal silicates), though suitable for such applications, are not sufficiently viscous to be used on superalloys at temperatures above 800° to 900°C, and do not have sufficiently high melting points to be used for coating refractory metals at their normally high operating temperatures.

The new glasses are stable and solid at temperatures up to 1000°C. They adhere well to the metal surfaces, and can be used for metals with a broad range of expansion coefficients. In addition, the glasses are thermally stable to approximately 1800°C without appreciable decomposition, and have sufficiently high viscosities to protect the metals from oxidation at high temperatures and high gas velocities.

The glasses may be easily crushed and powdered. The powdered glass can then be applied by conventional methods or in vacuum atmosphere. For example, the metal part may be heated in an induction furnace and the glass powder sprayed onto the hot surface in an inert gas stream. To provide an acceptable coating, the glass powder must melt and flow to cover the surface when brought in contact with the hot metal.

Notes:

1. The specific glass coatings used must be selected for compatability with the substrate metal and the environment to which the coated metal will be subjected.
2. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.65)

   Reference:
   NASA-CR-72520 (N70-14570), Development and Evaluation of Controlled Viscosity Coatings for Superalloys
3. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B70-10430

Patent status:

No patent action is contemplated by NASA.

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