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# NASA TECH BRIEF



## Alkali Silicate Vehicle Forms Durable, Fireproof Paint

**The problem:** To develop a paint for use on satellites or space vehicles that exhibits high resistance to cracking, peeling, or flaking when subjected to a wide range of temperatures. Organic coatings will partially meet the required specifications but have the inherent disadvantage of combustibility. Alkali-silicate binders, used in some industrial coatings and adhesives, show evidence of forming a fireproof paint, but the problem of high surface-tension, a characteristic of alkali silicates, has not been resolved.

**The solution:** Use of a suitable non-ionic wetting agent combined with a paint incorporating alkali silicate as the binder.

**How it's done:** Paint is formulated using an alkali silicate, either sodium silicate or potassium silicate, in water at about 35 percent concentration, conventional pigments, and a non-ionic wetting agent. The wetting agent is a derivative of a reaction between a polyhydric alcohol and a fatty acid. Incorporating the wetting agent, in proportions up to about 2 percent, reduces surface tension of the alkali silicate binder to a point where full contact may be established between the paint and substrate. This does not degrade the performance of the paint.

Because the coating is a completely inorganic compound it is fireproof and has a color stability superior to paints containing organic binders. The limiting factor in such a formula is not the silicate binding component but the pigment component. Because of the molecular bond between the binder and the metal being coated, the paint is attached firmly and permanently to the surface. Materials used to formulate the paint are inexpensive and easy to apply. The resultant coating has been found to be extremely hard and tough, and has high resistance to degradation or flaking when severely temperature-shocked, i.e., +150°C to -150°C. It has excellent resistance to marring, scratching, and mechanical shock.

Alkali-silicate paint can be applied to aluminum, magnesium, zinc, and copper, or to other surfaces that have a coating of one of these metals. The preferred method of application is by spraying to a thickness of 0.006 inch. Since the paint is water soluble when applied, cleaning the equipment is quick and easy.

**Notes:**

1. Excessive reactivity of the alkali silicate to the metal substrate is controlled by utilizing a high ratio of $SiO_2$ to $K_2O$. A mol ratio of 1 $K_2O$: 3.31 $SiO_2$ was found to be satisfactory.
2. Epoxy, fiberglass, and other plastic surfaces may be coated with this material, if a thin layer of suitable nonferrous metal is first deposited on the plastic surface.
3. Because of its anti-corrosion, grease-resistant, and fire-resistant properties, this paint could find application in consumer goods such as automobile parts and household appliances.

**Patent status:** NASA encourages the immediate commercial use of this invention. It is owned by NASA and inquiries about obtaining royalty-free rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

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