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Brief 66-10087

# NASA TECH BRIEF



## Solid-Film Lubricant Is Effective at High Temperatures in Vacuum

**The problem:**

To develop a stable solid-film lubricant for sliding surfaces in environments at elevated temperatures and gas pressures which may range from atmospheric to high vacuum.

**The solution:**

A solid film consisting of calcium fluoride and a suitable inorganic binder (e.g., cobaltous oxide, barium oxide, or boron oxide) is fused to the surface to be lubricated.

**How it's done:**

A mixture of calcium fluoride and a compatible binder having a coefficient of thermal expansion within approximately 10% of the base material and a melting point above the operating temperature of the sliding surfaces but below that of the base is ground to a fine powder. The powdered mixture is vigorously stirred in water to form a slurry, which is then applied to the surface of the base material by spraying, brushing, or by any other suitable method. A dispersing agent may be included in the slurry, but in most instances it is not necessary. The thickness of the coating may range from 0.0008 to 0.0035 inch. In the absence of a dispersing agent, the base should be maintained at a temperature of 150° to 200°F during application of the slurry to permit the water to evaporate shortly after contact and thus prevent undesirable running of the suspended particles. The coated article is then fired to fuse the particles to one another and bond the film to the base. For most applications, a firing temperature of approximately 2000°F is satisfactory. After firing, the coated article is brought to room temperature on a water-cooled steel block.

**Notes:**

1. This lubricant, with varying proportions of calcium fluoride and binder, has proven to be effective on various metals (including nickel-base alloys) at temperatures up to 1900° F in atmospheres containing oxygen or inert gases at pressures ranging from normal atmospheric to high vacuum. It is not stable in reducing atmospheres (e.g., hydrogen).
2. Previous NASA Tech Briefs on solid lubricants are B63-10453, November 1964 and B63-10562, July 1964.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio, 44135
   Reference: B66-10087

**Patent status:**

This invention has been patented by NASA (U.S. Patent No. 3,157,529), and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to NASA, Code GP, Washington, D.C., 20546.

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