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## Evaluation of Lubricants for Ball Bearings at High Temperatures

Ball bearings fabricated from high-temperature alloys (Stellite 6B balls and races and Reine 41 cages) were operated in air at temperatures up to 1500°F. The adherent oxides which formed on these alloys prevented bearing seizure and high wear on otherwise unlubricated bearings. However, bearing torque was high and erratic.

In previous basic studies of high temperature lubricants, new solid lubricants which had low friction coefficients and effective antiwear characteristics at elevated temperatures (1000°–1900°F) were formulated.

A test program was therefore begun to determine the feasibility of lubricating ball bearings with the solid lubricants which had appeared promising in the basic studies.

The solid lubricants were calcium fluoride-barium fluoride coatings which were applied to the bearing cages, or, in some cases, the cages were fabricated from self-lubricating composites consisting of porous, sintered nickel-chromium alloy impregnated with a calcium fluoride-barium fluoride eutectic filler. All tests were conducted in air.

The bearings (20-mm bore) were of the angular contact type. Under a 30-pound thrust load, which produced a Hertz stress of 93,000 psi at 1200°F, fluoride-lubricated bearings ran at 5000 rpm without fail-

ing for as long as 700 hours at 1200°F and 70 hours at 1500°F. The shortest lives under these conditions were of the order of 20 to 50 hours. Wear rates were very low until just prior to the onset of bearing failure.

### Notes:

1. The tests demonstrated that calcium fluoride-barium fluoride as coatings on bearing cages or as fillers in porous bearing cages could lubricate bearings successfully for operations in air at temperatures of 1200° to 1500°F.
2. Documentation is available from:  
Clearinghouse for Federal Scientific  
and Technical Information  
Springfield, Virginia 22151  
Price \$3.00  
Reference: B69-10025
3. Technical questions may be directed to:  
Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135

### Patent status:

No patent action is contemplated by NASA.

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