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AEC-NASA TECH BRIEF

Low-Temperature Radiation-Resistant Material for Ball-Bearing Retainers

A new material, made of polyimide polymers and S-glass (alumina-silica-magnesia) cloth and developed in the nuclear-rocket program, may replace fiberglass-reinforced polytetrafluoroethylene in ball-bearing retainers for extreme environments. The fluorocarbon material weakens badly at cryogenic temperatures and after nuclear radiation doses exceeding 10^9 erg/g. The new material shows satisfactory wear resistance, lubricity, and stability.

The S-glass cloth is wound on a mandrel of preset diameter matched in size with the bearing retainer. The cloth is impregnated with polybenzimidazole (PBI), in powder-slurry form, placed between and over the windings. The laminate is cured in five heat cycles ranging from 70° to 700°F at pressure between 0 and 100 lb/in^2 (gage). The cured part is machined to final size.

Polybenzimidazole has greater thermal stability than the fluorocarbons because of a greater degree of chain condensation. A major advantage in the use of S-glass is its freedom from elements such as boron that could become involved in nuclear reactions.

The following results were typical of comparative tests of the PBI and fluorocarbon materials: (1) while irradiation increased PBI's strength by 15%, it reduced the latter's by 81%; (2) while the PBI's rate of wear was slightly inferior at from 8500 to 12,200 rpm in liquid hydrogen, it was still acceptable; (3) after irradiation to 2×10^{10} erg/g, a retainer made of PBI was tested successfully for 3 hr at 24,000 rpm.

Note:

Requests for further information may be directed to:
Technology Utilization Officer
AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
Washington, D.C. 20545
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No patent action is contemplated by AEC or NASA.

Source: P. O. Desau and W. F. Emmons of Aerojet-General Corp. under contract to Space Nuclear Propulsion Office (NUC-10058)

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