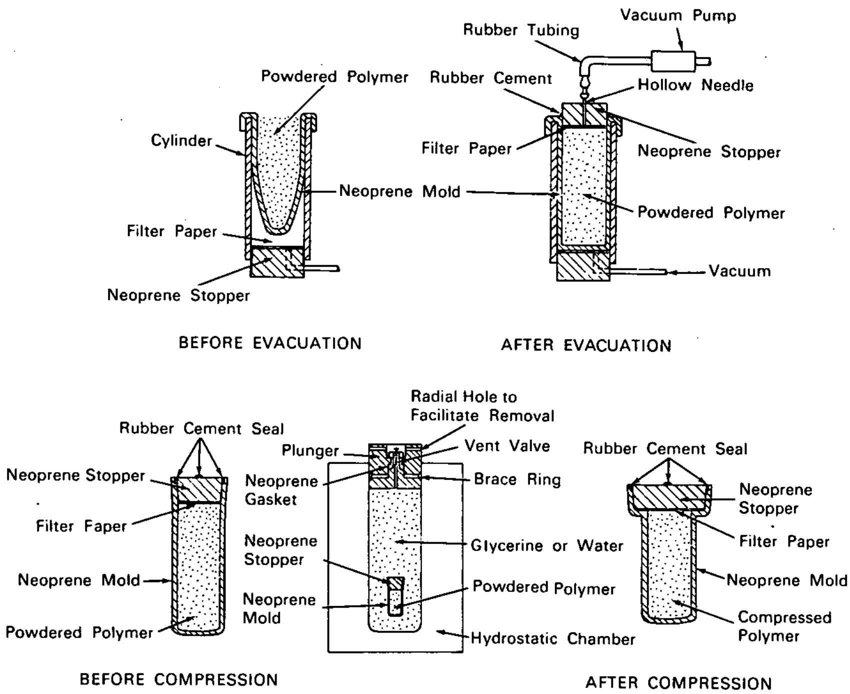
NASA TECH BRIEF

Isostatic Compression Process Converts Polyaromatics into Structural Material



LABORATORY APPARATUS FOR ISOSTATIC COMPRESSION

The problem:

To devise a process for compacting certain powdered aromatic polymers (e.g., polyphenylenes) into homogeneous materials that can be machined to form useful components, such as bearings. These materials are characterized by insolubility in strong bases, acids, and ordinary organic solvents; high-temperature stability; high radiation resistance; and good lubricity. Because of their insolubility and infusibility, the polyaromatics could not previously be fabricated into useful structures.

The solution:

An isostatic (hydrostatic) compression process, similar to that employed in the ceramics and powder metallurgy fields, but which provides for complete removal of air in the interstitial spaces surrounding the granules of the powdered polymer before the powder is subjected to isostatic compression.

How it's done:

The powdered polymer is placed into a neoprene mold that is retained within a cylinder, at the bottom of which is a neoprene stopper fitted with a filter

(continued overleaf)

paper and a vacuum pump connector. The top of the mold is fitted with a filter paper and a neoprene stopper which is penetrated by a hollow needle whose upper end is connected to a vacuum pump. Rubber cement is used to edge-seal the upper neoprene stopper to the rim of the neoprene mold.

All of the air is withdrawn from the contents of the mold and the space between the mold and the bottom of the cylinder by a vacuum pump. The hollow needle is then extracted from the upper stopper and the hole left in it is sealed with rubber cement. The flanged portion of the mold is finally lapped around the outer surface of the upper stopper and edge-sealed with rubber cement at the points of contact. The prepared mold (third figure) containing the air-free powdered polymer is placed in a conventional hydrostatic chamber (fourth figure) for isostatic compression of the polymer into a compact machinable billet as indicated in the fifth figure.

Notes:

1. Bearings made of a polyaromatic material produced by this process have a very low coefficient of friction in a hard vacuum as well as in air and were found to have a much longer life than bearings made of polytetrafluoroethylene.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B67-10168

Patent status:

No patent action is contemplated by NASA.

Source: G. K. Ostrum, D. D. Lawson, and J. D. Ingham (JPL-892)