

# NASA TECH BRIEF



This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

## Gallium Is Useful Bearing Lubricant in High-Vacuum Environment

**The problem:** To find a bearing lubricant that is effective in a high vacuum. Most ordinary lubricants, both liquid and solid, vaporize much too rapidly to be used for extended periods in space or in other high vacuum environments even at very low temperatures.

**The solution:** Use solid gallium (m.p. = 86°F., b.p. = 3,600°F.) as a lubricant in conjunction with bearings made of compatible materials.

**How it's done:** Many materials are chemically reactive with gallium, but others such as tantalum, zirconium, tungsten, carbon (graphite), ceramic, and glass are relatively impervious at low temperatures. Bearings made of these materials and lubricated with gallium will consequently perform quite well in a high-vacuum, low-temperature environment. Still other materials react with gallium to form gallium-rich intermediates, some of which provide adequate boundary lubrication with acceptable wear at room temperature even though the pressure is as low as  $10^{-9}$  millimeter of mercury. Materials of this lubricant-forming type include the 52100 and 440-C steels,

which are therefore probably more suitable than any other bearing material for use in a very high-vacuum environment with gallium as the lubricant. Since gallium is an expensive metal it cannot be recommended for use except in special circumstances where a less costly lubricant will not suffice.

**Note:**

For further information about this innovation inquiries may be directed to:

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**Patent status:** NASA encourages the commercial use of this invention. It has been patented by NASA (U.S. Patent No. 3,072,574), and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to NASA Headquarters, Washington, D.C. 20546.

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