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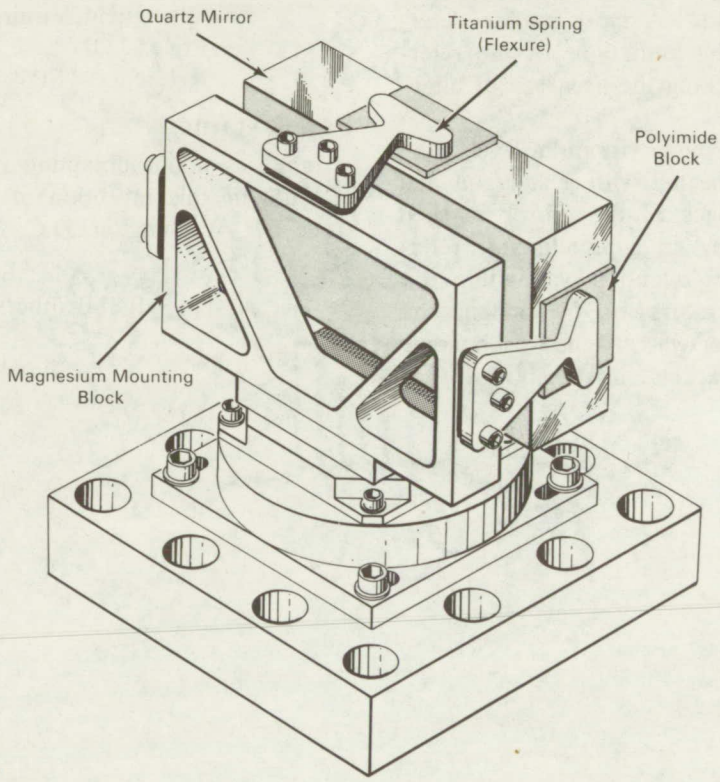
NASA TECH BRIEF

Precision Mounting for Instrument Optical Elements Provided by Polyimide Bonding



Mirror Mounting Detail

Epoxy resin-coated polyimide plastic may be the material chosen for bonding materials with different thermal coefficients in applications requiring precision mounting, for example, of instrument optical elements, especially where vibrations, temperature extremes, and low pressures are encountered.

Use of springs, set screws, or cushioned frames for mounting precision optical glass elements allows a minimum of 10 arc seconds of alignment shift during vibration and further alignment shift and surface distortion upon exposure to high temperatures. Bonded structures may hold alignment but transmit stress to the glass, thereby breaking it or the bond under these conditions.

For test purposes, a fused quartz mirror (6 in. × 3.35 in. × 1.25 in.) weighing 2.5 pounds was used

(continued overleaf)

as the optical element. The mirror mounting detail is shown in the drawing.

A thin layer of potting compound was applied to both sides of a small 2-square-inch block of polyimide plastic, 1/16 inch thick. This block was then affixed between the mirror and the thin titanium springs. Subsequently, these springs were attached with screws to a magnesium mounting block and the potting was cured.

The titanium springs serve as a bridge between the mirror and the magnesium mount, limit thermal conduction, and accurately maintain the mirror position. The magnesium frame serves for structural rigidity and allows heat radiated from the mirror to pass through the openings in the mount to prevent thermal expansion.

After vibrational tests, alignment of the mirror was within ± 5 arc seconds. A more precise determination was precluded by limitations of the reference system used for checking the accuracy of alignment.

Following exposure to high vibration levels, the front of the mirror was heated with a sun gun and the temperature of the back of the mirror reached 160°F. As determined by an autocollimator reference system, the alignment retention was within ± 1 arc second. The temperature of the magnesium mount, to which the mirror was attached by bonding material and titanium brackets, increased less than 3°F from the initial 75°F temperature of the mirror and mount.

It is predicted that this bonding technique will allow alignment to be maintained within ± 1 arc second from -50 to 180°F, if the frame temperature remains within 75 ± 5°F.

Epoxy resin coated polyimide plastic bonding material has extremely low vapor pressures, precluding outgassing problems and subsequent contamination in high vacuum. Polyimide is resistant to most organic solvents and dilute or weak acids; however, it is attacked by bases and by nitrogen tetroxide.

Note:

Documentation is available from:
Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10310

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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