



Two-Band, Low-Loss Microwave Window

Microwave loss is only about 0.4 percent.

NASA's Jet Propulsion Laboratory, Pasadena, California

A window for a high-sensitivity microwave receiving system allows microwave radiation to pass through to a cryogenically cooled microwave feed system in a vacuum chamber, while keeping ambient air out of the chamber and helping to keep the interior of the chamber cold. The microwave feed system comprises a feed horn and a low-noise amplifier, both of which are required to be cooled to a temperature of 15 K during operation. The window is designed

to exhibit very little microwave attenuation in two frequency bands: 8 to 9 GHz and 30 to 40 GHz.

The window is 15 cm in diameter. It includes three layers (see figure):

- The outer layer is made of a poly(tetrafluoroethylene) film 0.025 mm thick. This layer serves primarily to reflect and absorb solar ultraviolet radiation to prolong the life of the underlying main window layer, which is made of a polyimide that becomes weakened when exposed

to ultraviolet. The poly(tetrafluoroethylene) layer also protects the main window layer against abrasion. Moreover, the inherent hydrophobicity of poly(tetrafluoroethylene) helps to prevent the highly undesirable accumulation of water on the outer surface.

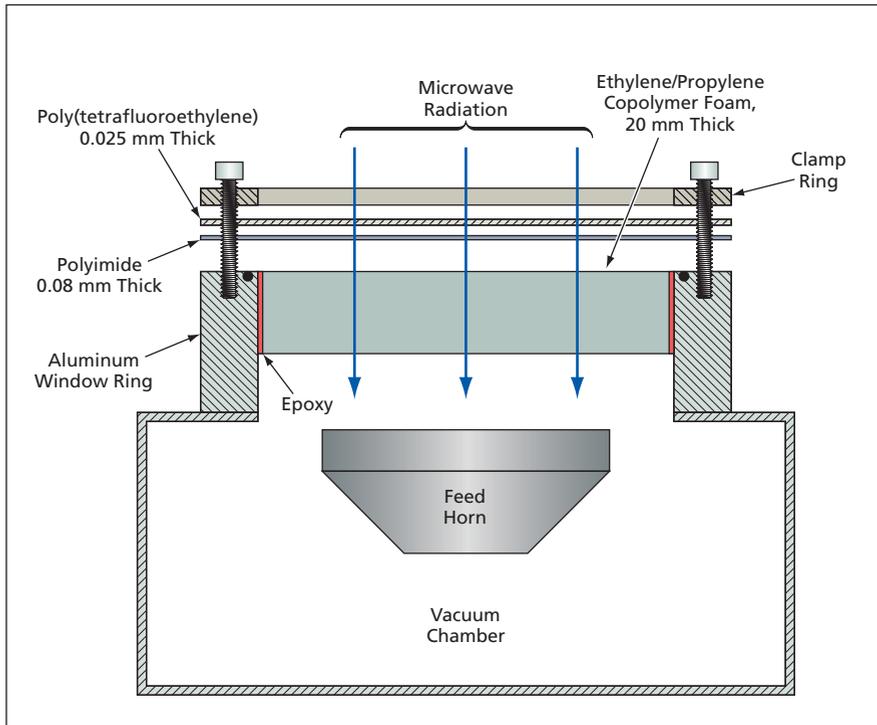
- The polyimide main window layer is 0.08 mm thick. This layer provides the vacuum seal for the window.
- A 20-mm-thick layer of ethylene/propylene copolymer foam underlies the main polyimide window layer. This foam layer acts partly as a thermal insulator: it limits radiational heating of the microwave feed horn and, concomitantly, limits radiational cooling of the window. This layer has high compressive strength and provides some mechanical support for the main window layer, reducing the strength required of the main window layer.

The ethylene/propylene copolymer foam layer is attached to an aluminum window ring by means of epoxy. The outer poly(tetrafluoroethylene) film and the main polyimide window layer are sandwiched together and pressed against the window ring by use of a bolted clamp ring.

The window has been found to introduce a microwave loss of only about 0.4 percent. The contribution of the window to the noise temperature of the microwave feed system has been found to be less than 1 K at 32 GHz and 0.2 K at 8.4 GHz.

This work was done by Michael Britcliffe and Manuel Franco of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

NPO-40846



This Low-Loss Microwave Window is made from commercially available materials and is relatively inexpensive.

MCM Polarimetric Radiometers for Planar Arrays

In mass production, these would cost less than do traditional polarimetric radiometers.

NASA's Jet Propulsion Laboratory, Pasadena, California

A polarimetric radiometer that operates at a frequency of 40 GHz has been designed and built as a prototype of multiple identical units that could be arranged in a planar array for scientific

measurements. Such an array is planned for use in studying the cosmic microwave background (CMB).

All of the subsystems and components of this polarimetric radiometer are inte-

grated into a single multi-chip module (MCM) of substantially planar geometry. In comparison with traditional designs of polarimetric radiometers, the MCM design is expected to greatly reduce the