Optical-Quality Thin Polymer Membranes

Surface roughnesses and thickness variations are small enough for demanding scientific applications.

Marshall Space Flight Center, Alabama

A method of fabricating both curved and flat thin polymer membranes of optical quality has been developed. The method was originally intended to enable the fabrication of lightweight membrane imaging and interferometric optics, possibly with apertures multiple meters wide, for use in scientific instruments that would operate in outer space. The method may also be applicable to the fabrication of lightweight membrane optics for terrestrial use.

The method involves flow-casting of a soluble polymer with mechanical and environmental controls that provide nearly ideal conditions for the formation of a membrane. The preferred environmental conditions and other details of the process depend on the choice of polymer and substrate material and on the shape and size of the membrane to be cast. Once the polymer has dried to a membrane, it is cured with convective heating, then released.

Membranes with root-mean-square surface roughnesses of <10.5 Å can be produced routinely by this method. Variations in the thicknesses of the membranes have ranged from 1/3 wavelength down to as little as 1/20 wavelength (at a wavelength of 633 nm). Membranes fabricated thus far have had diameters up to 0.5 m, and there appears to be no major obstacle to scaling up to multiple-meter diameters.

This work was done by James Moore and Brian Patrick for **Marshall Space Flight Center**. *Further information is contained in a TSP (see Page 1).*

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