



NATIONAL RADIO ASTRONOMY OBSERVATORY

ELECTRONICS DIVISION TECHNICAL NOTE NO. 118

TITLE: Leak Tests of Various Polymers

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LEAK TESTS OF VARIOUS POLYMERS

Roger D. Norrod

Troy Henderson and I have measured the leak rate of several types of polymers, searching for a good, low frequency, waveguide window material. This note summarizes the results of those tests.

Test Procedure:

The NRC 925 mass spectrometer was calibrated with a standard leak (5.4×10^{-8} cm³/sec). The test fixture (see sketch) was mounted with a solid stainless steel cap covering the orifice, and the detector background was checked (background $< 10^{-9}$ cm³/sec). The test fixture was covered with a plastic bag, and the bag pumped full of helium. No response was observed after 10 minutes, indicating O-ring leakage was negligible. Each sample was then mounted, the background was pumped to a level less than 10^{-9} cm³/sec, the plastic bag was pumped full of helium, and the time until the leak rate stabilized was recorded. After each sample, the solid stainless cover was installed and the background checked. At the conclusion of the tests, the detector calibration had drifted to 7.6×10^{-8} cm³/sec with the standard leak. As a final check for leakage past the O-ring, a sample was mounted, but clamped with the solid cover, and the test repeated. No detector response was observed after 12 minutes. The results of these tests are summarized in the table.

Conclusions:

The high density polyethylene cut from rod stock was the best sample tested with the same material cut from sheet stock not much worse. The UHMW polyethylene is quite expensive, and there does not seem to be any advantage to its use. The high density polyethylene is available from:

AIN Plastics, Inc.
P. O. Box 14369
Norfolk, VA 23518

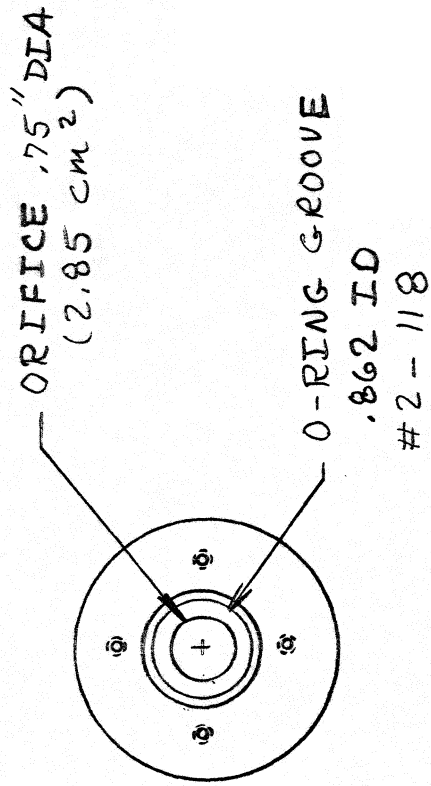
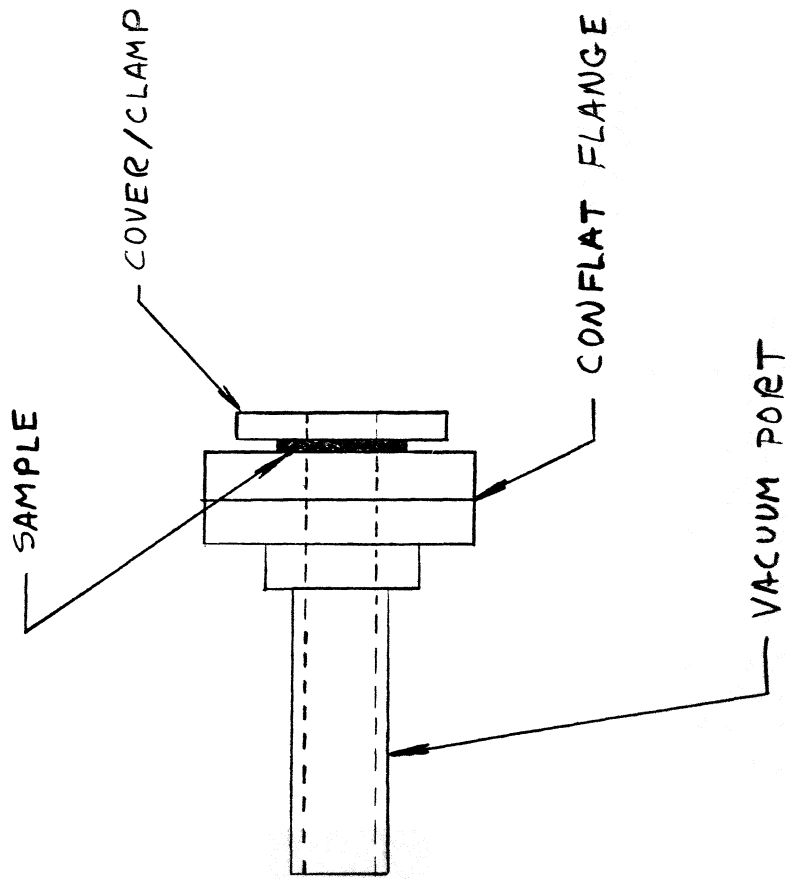
(800) 446-8278

I have a supply of the sheet stock, so anyone interested in trying some can call me for samples.

RDN/cjd

Attachments

1. Sketch of Test Fixture
2. Table: Summary of Leak Tests



SAMPLE & CLAMP
REMOVED

TEST FIXTURE
25 OCT 83
RON

Summary of Leak Tests

Sample	Source	Absolute Leak Rate (10^{-8} cm ³ /sec)	Normalized Leak Rate $\left(10^{-8} \frac{\text{cm}^3/\text{sec}}{\text{cm}^2}\right)$	Time to Stable Leak Rate (min)
Rexolite Sheet, 0.050" thick	Charlottesville	>60	>20	2 1/2
Stycast 0005, 0.069" thick	Emerson-Cuming	>60	>20	3 1/2
High Density Polyethylene cut from rod, 0.050" thick	AIN Plastics	8.2	2.9	10
Plexiglas, 0.050" thick	Green Bank Shop	40	14	8
Rexolite cut from rod 0.050" thick	Charlottesville	>60	>20	2
Virgin TFE, 0.036" thick	Cadillac Plastics	>60	>20	2
Linear Polyethylene, 0.031" thick	US Plastics	>60	>20	5
Mylar, 0.010" thick	Charlottesville	>60	>20	1
High Density Polyethylene cut from sheet, 0.050" thick	AIN Plastics	15	5.3	10
Ultra High Molecular Weight (UHMW) Polyethylene cut from sheet, 0.050" thick	AIN Plastics	26	9.1	10

* The leak detector saturated at 60×10^{-8} cm³/sec.