

**A VERY-THIN WALLED SAMPLE HOLDER FOR LIQUIDS\***

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Received 22 March 1963

A sample holder for liquids is described which was developed for use in neutron scattering measurements. The design is very simple and inexpensive to fabricate, yet the walls of the

container are very thin, 0.002" aluminum, reducing this contribution to the background to a minimum.

In the course of preparing a sample for investigating neutron scattering from light water, the sample holder described below was developed. The sample was to be thin (about 0.010 in.) so as to reduce multiple scattering and was to be held between windows of minimum thickness to reduce background scattering from the sample holder. Although Bragg scattering may be important, aluminum was chosen as the material for the sample holder because of its low cross section and because of its availability in a variety of thicknesses. The clamp rings are also of aluminum. The principle by which the walls of the sample holder are held flat and sealed, which is thought to be unique in this application, depends upon squeezing an O-ring into a groove with beveled sides in such a way that the O-ring expands diametrically while being squeezed (see fig. 1). The aluminum foils are held tightly by the O-ring and are uniformly stretched two-dimensionally, while simultaneously the O-ring makes a seal against the foils. The desired sample thickness is established by a spacer between the foils. The spacer is of 0.01 in. brass, 3.60 in. i.d., 3.80 in. o.d. Two common hypodermic needles (no. 23) penetrate the O-ring opposite a 0.250 in. gap in the spacer (see fig. 2). One is used with a syringe to fill the assembled sample holder and the other acts as a vent.

The dimensions of the groove are somewhat critical because the stretching of the foils must be uniform and great enough to remove wrinkles in

\* Work supported by U.S. Atomic Energy Commission, Contract No. AT(11-1)-917.

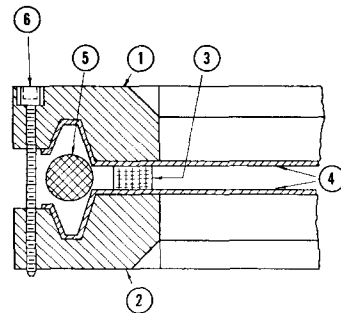


Fig. 1. Schematic drawing of the assembled sample holder (not to scale).

- 1. Al upper clamp ring
- 2. Al lower clamp ring
- 3. 0.01 in. brass spacer
- 4. Al foils
- 5. Neoprene O-ring
- 6. Allen-head screws

the foils. One set of dimensions which work is shown in fig. 3. These dimensions were arrived at after a series of trials which would presumably have to be repeated for chambers of different diameters. The Neoprene O-ring worked well, but a Teflon O-ring did not, presumably because of Teflon's lack of resiliency and low coefficient of friction. Films of polyethelene, Teflon and Mylar were easily stretched but sagged excessively when filled. The 0.002 in. aluminum was chosen over thinner aluminum foils to eliminate the problem of sagging.

In assembling the holder a certain amount of care is required. One should start with fairly flat foils, although minor wrinkles are easily stretched out. After the foils, O-ring and spacer are in place, clamping screws are brought down gradually and

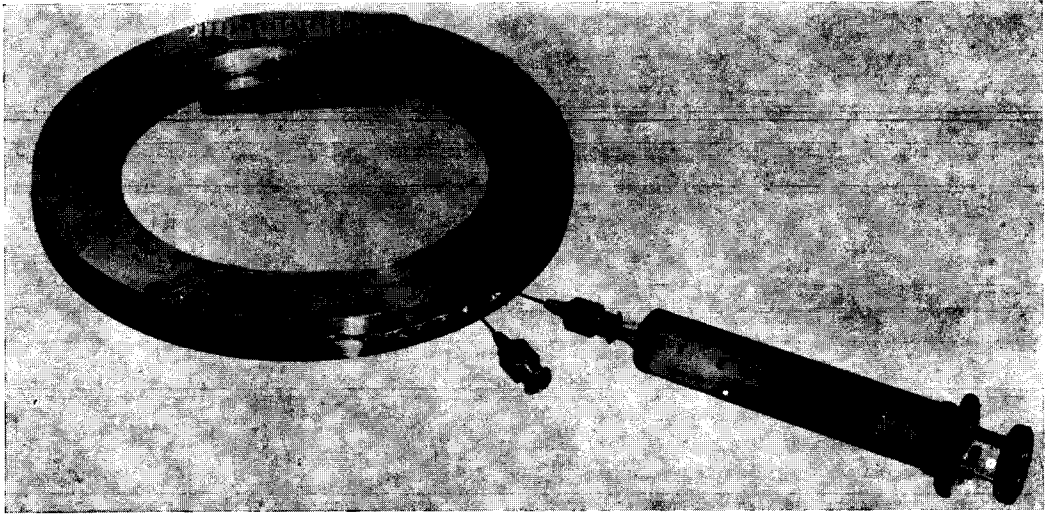


Fig. 2. The assembled sample holder with syringe used for filling and second hypodermic needle used for venting. The two-inch scale is graduated in tenths of inches.

alternately around the periphery. Tightening the screws down too far twists the clamp rings and allows wrinkles to form in the foils. A little grease between the foil and the clamp rings reduces friction and helps in stretching. As it is quite easy to

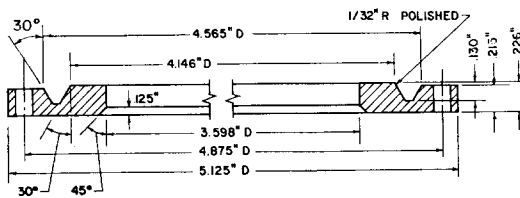


Fig. 3. Section through the diameter of one clamp ring, showing dimensions which produced satisfactory stretching of foils. In upper clamp ring, drill clearance holes and counter bore for no. 6-32 Allen-head cap screws. Drill and tap no. 6-32 in lower clamp ring. Neoprene O-ring  $4\frac{1}{8}'' \times \frac{3}{8}''$  diam. X-sec.

force too much fluid into the assembled chamber with the syringe during filling, some care must be taken; although when the excessive fluid is removed the foils seem not to have taken a permanent set, and return to a flat condition. Oxidation of the foils is prevented by spraying a light coat of Krylon lacquer on their inner surfaces. The flatness of the filled sample holder is easily checked with a depth micrometer. Medical X-ray film (no screen) easily exhibits voids in the sample when X-rays from a tungsten target X-ray tube (no filtration) are used at 10 KVP and a current of 1 mA for an exposure time of 1 sec. The film and sample are placed 11 in. from the target.

The authors wish to thank the Aluminum Company of America for providing foils used for this work.