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CASTING ASTROLITE CYLINDERS

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UCRL-3179
Instrumentation Distribution

UNIVERSITY OF CALIFORNIA
Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

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October 28, 1955

Printed for the U. S. Atomic Energy Commission

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In the course of our cloud chamber experiments at the 184-inch cyclotron and the Bevatron it became desirable to use an alcohol-and-water mixture in the cloud chamber. The cylinder of the chamber was made of lucite, which crazes on exposure to an alcohol atmosphere. Since the cylinder must also transmit light, it must be free from defects. The size and design of the chamber eliminated the possibility of using glass, so the most logical choice of material was of some alcohol proof plastic.

Curved sections of Astrolite R-250 had been cast, so we decided to attempt casting a complete cylinder.

The original mold for casting the curved sections was metal. This gave a smooth surface, but the breakage rate was approximately two out of three. This made us decide on an entirely new approach.

The first mold was made of sheets of 3/4-inch plywood glued together until a block 4-inches high was constructed. The center was then cut out and saved.

The cylinder size needed was 22 inches o. d. (21 inches i. d.) by 3.5 inches high. Since Astrolite shrinks about 5% on curing, the outside diameter of the mold was made 24 inches. This left sufficient material for machining and polishing. The core was cut to a diameter of 21-1/8 inches. This also left enough material for machining and polishing.

Because of the shrinkage, the core had to be cut into sections so that it could be removed before final curing. This was done by cutting two 2-inch sections across the diameters at right angles to each other, and using wooden blocks to replace the removed material.

It was necessary to coat the wood with some release agent to prevent the plastic from adhering. It was discovered that Casco glue was not affected by the resin, so the mold was sanded smooth and given three coats of Casco glue, sanded between each coat. The final coat was then waxed.

The mold was assembled on one piece of 3/4-inch plywood that served as a bottom for the mold. Duct seal was used to seal all joints, and any excess was cut away.

The success of this casting technique depends on the removal of the core and the freeing of the cylinder from the mold at just the time when the resin has reached the jell state. The time required for the jell state to be reached depends on several factors: i.e., age of resin; room temperature; size of mold; and the relative proportions of resin, catalyst, and cold-setting promoter. Very little research was done on this phase, but the following may serve as a rough guide. These are the only data gathered. (Room temperature was approximately 70°F. or 20°C.)

R 250	1900 cc	1900 cc	1900 cc
catalyst	125 drops	125 drops	125 drops
cold-setting promoter	20 drops	11 drops	7 drops
jell time	approx. 9 hr	13 hr	15 hr

The liquid mix was put in a bell jar and the pressure was dropped by vacuum pump to remove the entrapped air before it is poured in the mold.

When the resin had reached the jell state a well-waxed spatula was passed between the casting and the mold in order to remove the core. After the casting was removed it was permitted to remain at room temperature until the exothermic reaction was complete; then it was cured in an oven for 6 hours at 100°C.

Recently a variation of the technique described above has been tried. The mold was lined with aluminum foil and all joints were sealed with spray-booth coating. This eliminated the use of the spatula and the duct seal and made removal of the core and casting much simpler. The foil that adhered to the casting was machined off. The cylinders cast in this manner seemed to have more internal stresses than those cast with the first technique, but this has not been proved definetly as yet.

This work was performed under the auspices of the U. S. Atomic Energy Commission.

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