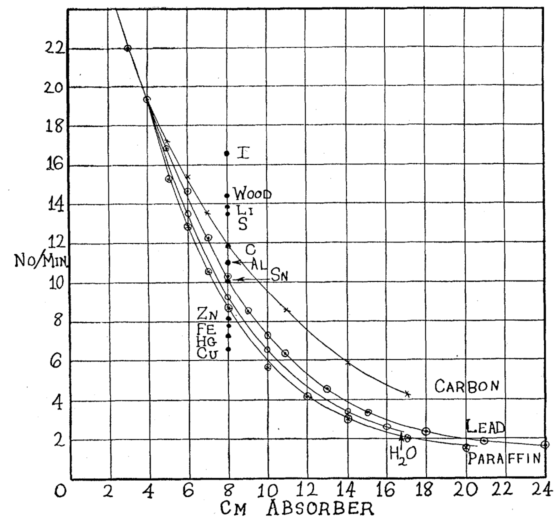


FIG. 1

for the lead nucleus. The size of the lead nucleus accords with radioactive disintegration theory, but the radius assigned to the neutron seems too large to permit it to fit into nuclei. If we introduce the hypothesis of an angle function for the scattering, such that small angle scattering is relatively greater for heavier atoms, the neutron radius will need to be smaller. Professor Rabi has kindly investigated the wave mechanics picture far enough to conclude that the scattering function for small angles is really of this type, and that our data lead to a more reasonable value, of the order of $1.2\times10^{-13}$ cm, for the neutron collision radius.

J. R. DUNNING
G. B. PEGRAM

Columbia University,
March 6, 1933.

[1] de Broglie, le Prince-Ringuet, Thibaud and La Tour, Comptes Rendus **194** (1932).

[2] J. R. Dunning, Phys. Rev. **43**, 380A (1933).

## Evaporation Technique for Aluminum

Mirrors made from aluminum by the evaporation technique are superior to silver in several respects as listed below. The reflectivity of aluminum is very nearly as high as silver for green light but is much higher for the ultraviolet[1] making possible the use of mirrors for ultraviolet optics where the lack of achromatism in a lens system is often objectionable.

The aluminum mirrors, now exposed for over six months, show no tarnish. The permanence of the high reflectivity definitely exceeds that of silver protected by an evaporated quartz layer.[2] The aluminum is inert toward corrosive agents because of a layer of oxide which forms on the aluminum upon contact to the air.

The aluminum adheres to glass more tenaciously than silver so that dust, etc., may be washed off with soap and water. One small glass grating coated with aluminum has been washed several times a week for a period of about three months without any harmful effect to the mirror and, furthermore, without introducing the small scratches which silver exhibits after being cleaned.

Other features, such as its apparent uniformity of reflectivity and transmission in the visible, may make of aluminum an important material for coating interferometer plates.

The evaporation of aluminum from a tungsten helix may be successfully effected when the proper size of tungsten wire and helix are chosen.

The technique of evaporation depends upon the fact that tungsten has a limited solubility in liquid aluminum. When the wire of the tungsten helix is large enough it is possible for the aluminum to become saturated with tungsten before the wire is dangerously reduced in diameter. For the successful evaporation of aluminum the helix may be 8 turns of 30 mil tungsten wire wound (in a Bunsen flame at red heat) on an 8 d. finishing nail to form a coil about one inch long. When the pitch of the helix is much less than 8 turns per inch the aluminum shorts the coil and is inefficiently heated by the electric current. When, however, the diameter of the helix is greater, the ratio of aluminum to tungsten is too great and the coil burns out. Furthermore, when a helix is made of wire of diameter larger than 30 mil the coil is excessively brittle.

The tungsten which is dissolved by the aluminum is deposited back on the helix as the evaporation proceeds. This may be sintered to the helix by a final heating of the empty coil and so approximately compensates for the dissolution of metal by the aluminum. Ordinarily one coil of tungsten lasts for some dozen charges of aluminum. The aluminum is cut in the form of a cylinder which fits easily into the helix. As the purest aluminum gives best results as regards tarnishing and adhesion, it is advisable to melt the aluminum to the helix to free it from gas and oxide before the mirror is uncovered. This may also be accomplished by a preliminary run to fuse the aluminum after which the apparatus is dismounted and the mirror introduced into the vacuum chamber. Other than this the technique is the same as has been described before[1] for the vacuum evaporation of metals.

JOHN STRONG*

California Institute of Technology,
March 8, 1933.

* National Research Fellow.

[1] W. W. Coblentz and R. Stair, Bur. Standards J. Research **4**, 189 (1930).

[2] C. Hawley Cartwright and John Strong, Rev. Sci. Inst. **2**, 189 (1931).