Puncture Collimator for the Laue Back Reflection Technique

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FIG. 1. Puncture collimator for the Laue back reflection technique.

paper at the penetration point of the tube. The application of the puncture collimator facilitates precise determination of crystal orientation. This is due to the fact that the penetration point of the incident beam on the film is well defined as the center of the 1 mm circular hole. With crystals of good quality, the puncture collimator yields small, well defined reflection spots, and the orientation can be determined with an accuracy better than 0.1° .

Highly Reflective, Adherent, Thick Aluminum Films on Glass

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FOR a spectroscopic study of chemical and anodic oxidation of aluminum, we desired to reproducibly evaporate onto thin glass slides highly reflective films of aluminum of about $1\ \mu$ thickness. We further required that these films be capable of withstanding a standard tape test and that they can be boiled in distilled water for at least $\frac{1}{2}$ h with no sign of blistering or peeling. Finally it is necessary that they can be anodically oxidized to at least 200 V. Various parameters such as substrate temperature, evaporation rate, residual gas pressure in system, and film thickness strongly influence the smoothness of evaporated films¹ and their adherence to the glass. In particular a high substrate temperature seems desirable for good adherence, but detrimental to the reflectivity. Our objectives have been finally achieved by the following technique:

We use a vacuum bell jar system capable of producing a vacuum in the 10^{-8} Torr range. The system is equipped to

FIG. 1. Heating, cooling, and evaporation assembly.

accommodate the electrical circuitry for one tungsten evaporating filament and, for the purpose of heating the glass substrates, two GE infrared quartz lamps. There are also water feedthroughs for cooling the substrates rapidly and a shutter arrangement between the filament and substrates to control evaporation.

The glass slides go through a rigorous cleaning procedure involving various steps such as washing in a hot detergent solution, rubbing with a slurry of Precisionite and water, ultrasonic and chromic acid treatments, followed by rinsing in boiling distilled water. From here on they are only handled with tweezers.

The slides to be coated are clamped to a 1.6 mm thick nickel plate with a spring loaded thermocouple pressing on the front surface of one of them to monitor the temperature throughout the run. This assembly is then bolted to a 3 mm copper plate that can be water cooled (Fig. 1).

A conical basket type tungsten filament holding about 1 g of very pure aluminum (about 99.999%) is mounted on two of the electrical feedthroughs and centrally located 20 cm below the substrates. Two GE quartz infrared 500T3 lamps are placed about 7.6 cm apart and about 2.5 cm below the substrates and in a position so as not to obstruct the evaporation of the aluminum to the substrates.

The evaporation system is exhausted to a pressure of 10^{-6} Torr or better. An adjustable transformer operates the infrared lamp circuit and power is applied until the substrate temperature reaches 300°C . This heating is maintained for 1 h. The power is then turned off and water is circulated through the copper cooler until the substrate temperature reaches 250°C . The reduction in temperature should be accomplished in a short time, preferably 1–2 min. Just prior to this the aluminum bearing tungsten basket evaporator is brought up to temperature. When the temperature of the substrate reaches 250°C , the shutter is opened and a small but visible amount of aluminum is evaporated onto the substrate. The shutter is closed and

FIG. 2. Electron micrograph of evaporated aluminum film.