A Temperature Control Stage for Deposition of Thin Metal Films

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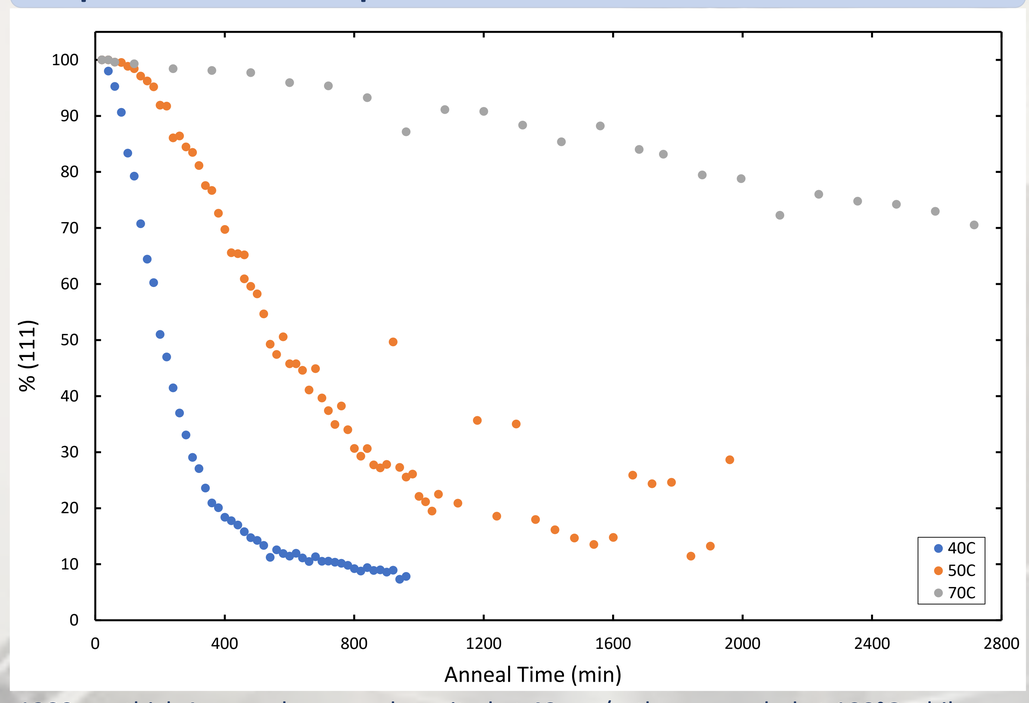
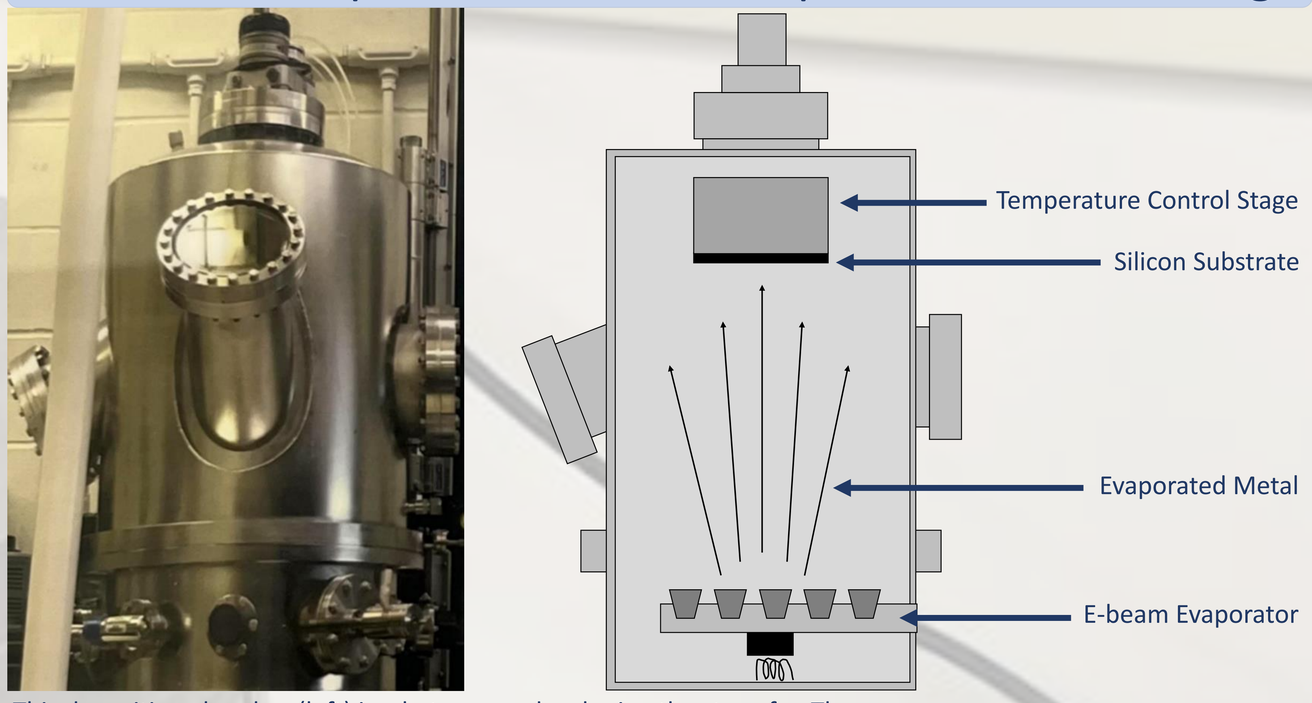
Deposition Temperature Affects Film Behavior



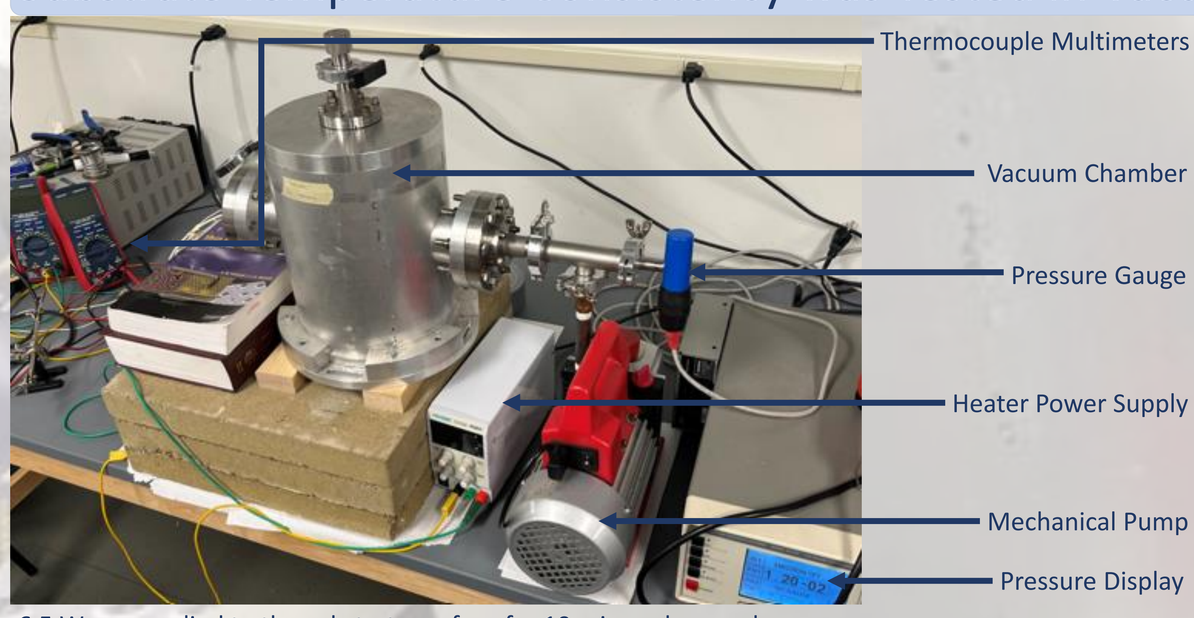
1200 nm thick Ag samples were deposited at 40 nm/s, then annealed at 100°C while measuring the percentage of the film with crystallites oriented in the (111) direction.

The Cornell Evaporator Needs an Improved Substrate Stage

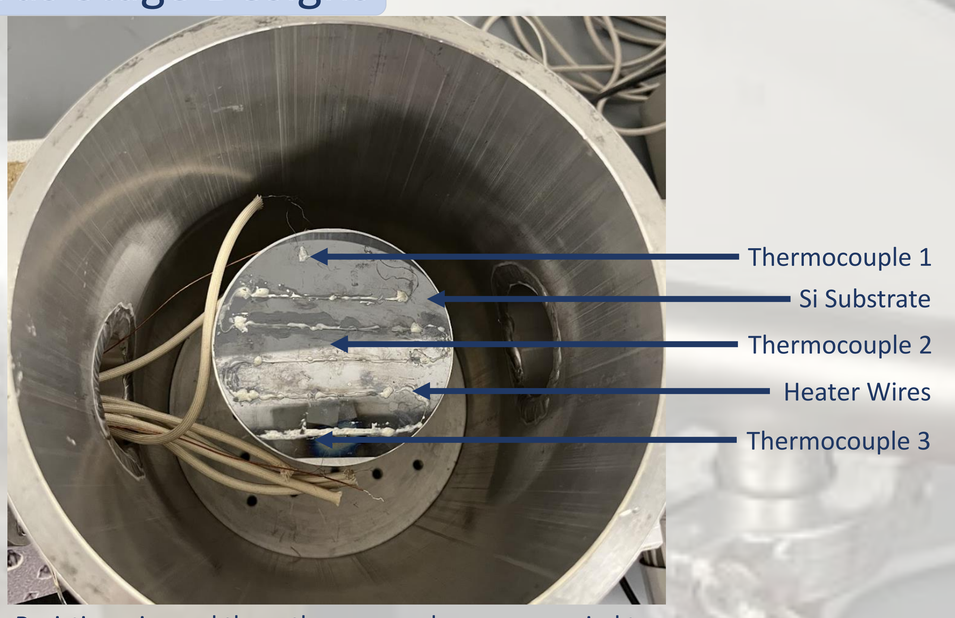


This deposition chamber (left) is what we are developing the stage for. The diagram (right) shows the interior workings that produce the thin metal films.

Substrate Temperature Consistency was Tested in Vacuum with Various Stage Designs

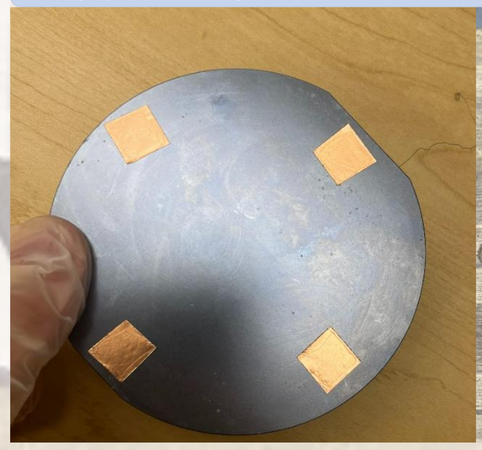


6.5 W was applied to the substrate surface for 10 min under rough vacuum to simulate the radiative power from the target.



Resistive wire and three thermocouples were epoxied to the substrate, which was mounted to a 6 in. flange or a 4 in. dia, 7.5 in. tall Al heat sink in the chamber.

Copper tape with clamps was compared to Ag paste adhesive. Paste is difficult to remove

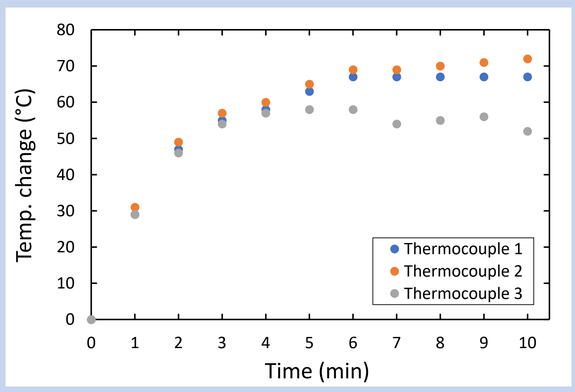


Pieces of 1.6 cm^2 Cu tape were adhered to the underside of a Si substrate (left) to increase thermal conductivity from the substrate to a heat sink. A tool (right) was built to remove the substrate from the flange.

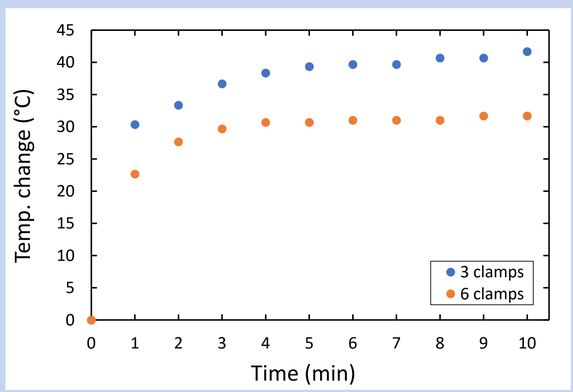
Al clamps pressed the taped substrate onto a 6 in. dia conflat flange.

The substrate was epoxied on an Al heat sink with Ag paste (left) for increased thermal conductivity. To remove the paste, the heat sink was held upside down in an acetone bath (right).

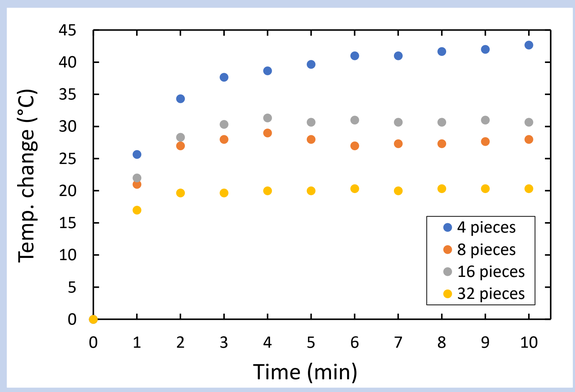
Ag paste maintained 10 times more constant temperature



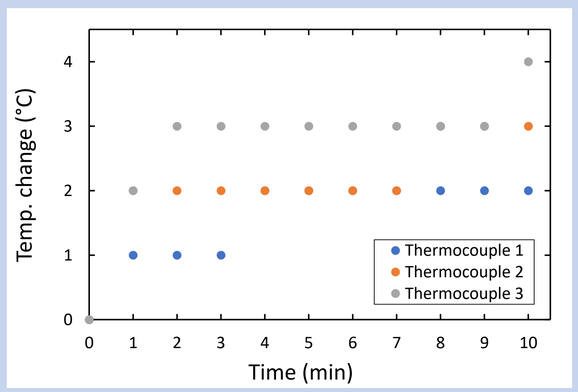
Control experiment: Includes three thermocouples connected to the Si substrate, resting on a 6 in. conflat flange with minimal contact.



Temperature change vs. Time using two different amounts of clamps: 3 pieces of tape were used. There is a 25% decrease in temperature change when increasing amount of clamps from 3 to 6.



Temperature change vs. Time using various amounts of tape: 3 clamps were used. The temperature change was halved when going from 4 pieces of tape to 32.



Temperature change vs. Time using Ag paint: Includes three thermocouples connected to the Si substrate. The temperature changed 8 to 10 times slower than with tape and clamps.