PMMA / P(MMA-MAA) BILAYER PROCESS

1. Spin P(MMA-MAA) copolymer 13% solution in ethyl lactate. You should refer to this as "copolymer," not as "EL13," since "EL" is an abbreviation for the solvent ethyl lactate. Spin for about 2 minutes or until the film looks uniform. Bake at 180°C for about 2 minutes. The bake time and temperature are not critical.

   Approximate thickness of P(MMA-MAA) EL13 spun at 3krpm: 800 nm
   Confirm this with a profilometer after scratching the film with tweezers. The thickness of this bottom layer is critical for tunnel-junction processes that use angled evaporation (eg the Dolan process or the bridge-free process.)

2. Let the wafer cool at least 30 seconds after removing it from the hotplate.

3. Spin 950k MW PMMA, 3% or 4% solution in anisole.
   Spin for about 1 minute or until the film looks uniform.
   Bake at 180°C on a hotplate, for about 2 minutes. The bake time and temperature are not critical.

   Approximate thickness of 3% PMMA spun at 3 krpm: 150 nm
   Approximate thickness of 4% PMMA spun at 3 krpm: 200 nm

   Confirm the total thickness by scratching the film with tweezers and using a stylus profilometer (the Dektak or Alphastep)

4. Expose at 100 kV
   Typical large-area dose is 1000 $\mu C/cm^2$
   Be sure to include the standard dose test AND the standard undercut test on each substrate.

5. Develop in IPA:water 3:1 at 5°C for 2 minutes. The longer development time is necessary because the resist layer is thick, about 1 μm. You can use other temperatures, but it is important to be consistent. The development temperature is important.

   For a larger undercut, use 10:1 IPA:water at 5°C for 2 minutes (or choose some other temperature, but be consistent.)

   Blow dry with nitrogen, or spin dry. Do not rinse in anything else, especially not alcohol.

6. Liftoff: evaporate metal, eg 5 nm Cr then 20 nm Au, then soak off the PMMA in NMP at 150°C. Do not heat the NMP above 200°C. Alternatively, use acetone. Do NOT heat acetone, since it is highly flammable. Ultrasonic agitation will not really help, but go ahead if you are desperate.