

PMMA/Copolymer double layer resist

Double resist layer should be used when a larger undercut resist profile is needed for lifting off thicker deposited materials. The Copolymer is used as a bottom layer with PMMA on top. In this case the higher sensitivity of the Copolymer is traded for the higher resolution of PMMA.

Characteristics:

- Positive tone
- Very high resolution
- **Limitation: Due to the undercut, line separation must be more than 500 nm**
- Poor dry etch resistance
- No shelf life or film life issues
- Not sensitive to white light
- Developer mixtures can be adjusted to control contrast and profile

Resist available at TNFC	Copolymer (MMA (8.5) MAA EL11) and 950k PMMA A3
Storage	10-27 °C
Surface Preparation	In general, no surface preparation aside from normal cleaning is necessary. Good adhesion to most surfaces.
Spin and pre-bake	<p><u>First layer – Copolymer</u> (spin speed 1000-5000 rpm, 60 sec. (500-1000 nm)) Pre-bake: 180°C hotplate, 3 min. May also be oven baked at 170°C for 30 min.</p> <p><u>Second layer – PMMA</u> (spin speed 1000-5000 rpm, 60 sec. (100-300 nm)) Pre-bake: 180°C hotplate, 3 min. May also be oven baked at 170°C for 30 min.</p>
Expose	Dose around 1000 $\mu\text{C}/\text{cm}^2$ at 100 kV (the dose of PMMA)
Develop	MIBK:IPA 1:3, 1-2 minute
Rinse	IPA, 30 sec
Dry	By dry N ₂
Post-Bake	Not normally necessary. Flow can begin at as low as 120°C. Does not seem to noticeably improve adhesion or etch resistance.
Descum	Light! PMMA etches very fast in oxygen. In an oxygen plasma asher, times can be around 1 minute, but beware! Do not preheat the PMMA. Removal rates increase dramatically with temperature.
Stripping	Most solvents, including acetone and methylene chloride will strip PMMA, as will NMP (Remover 1165). It is removed very well by strong bases (KOH), and by acid normally hostile to organics, such as NanoStrip. Oxygen plasmas etch PMMA very well.

Link to PMMA/Copolymer manufacturer's data sheet:

https://kayakuam.com/wp-content/uploads/2019/09/PMMA_Data_Sheet.pdf