Copolymer PMMA/MA 33 % as E-Beam Resist Series
AR-P 617 in 1-methoxy-2-propanol

1. General Description

The E-Beam Resist Series AR-P 617 are positive working resists suitable for all kinds of e-beam applications. These resists are filtered to a particle size of 0.2 µm.

The resists AR-P 617 are designed to meet high requirements of mask production in advanced integrated circuit fabrication. The copolymer layers are distinguished by an excellent adhesion on glass, silicon and metal.

By reason of their specific chemical properties the **copolymer e-beam resists** show a significant 3-4 times higher sensitivity and even higher contrast as PMMA resists. Developed pattern have a thermal stability up to 140 °C.

The AR-P 617 can be used for multilayer processes and planarisation. Resists with low solids content for resist thickness` down to 30 nm are suitable especially for the nanometer lithography.

2. Chemical Composition

Copolymers based on methylmethacrylate and methacrylic acid mainly dissolved in 1-methoxy-2-propanol (AR-P 617, Flash point: 38 °C).

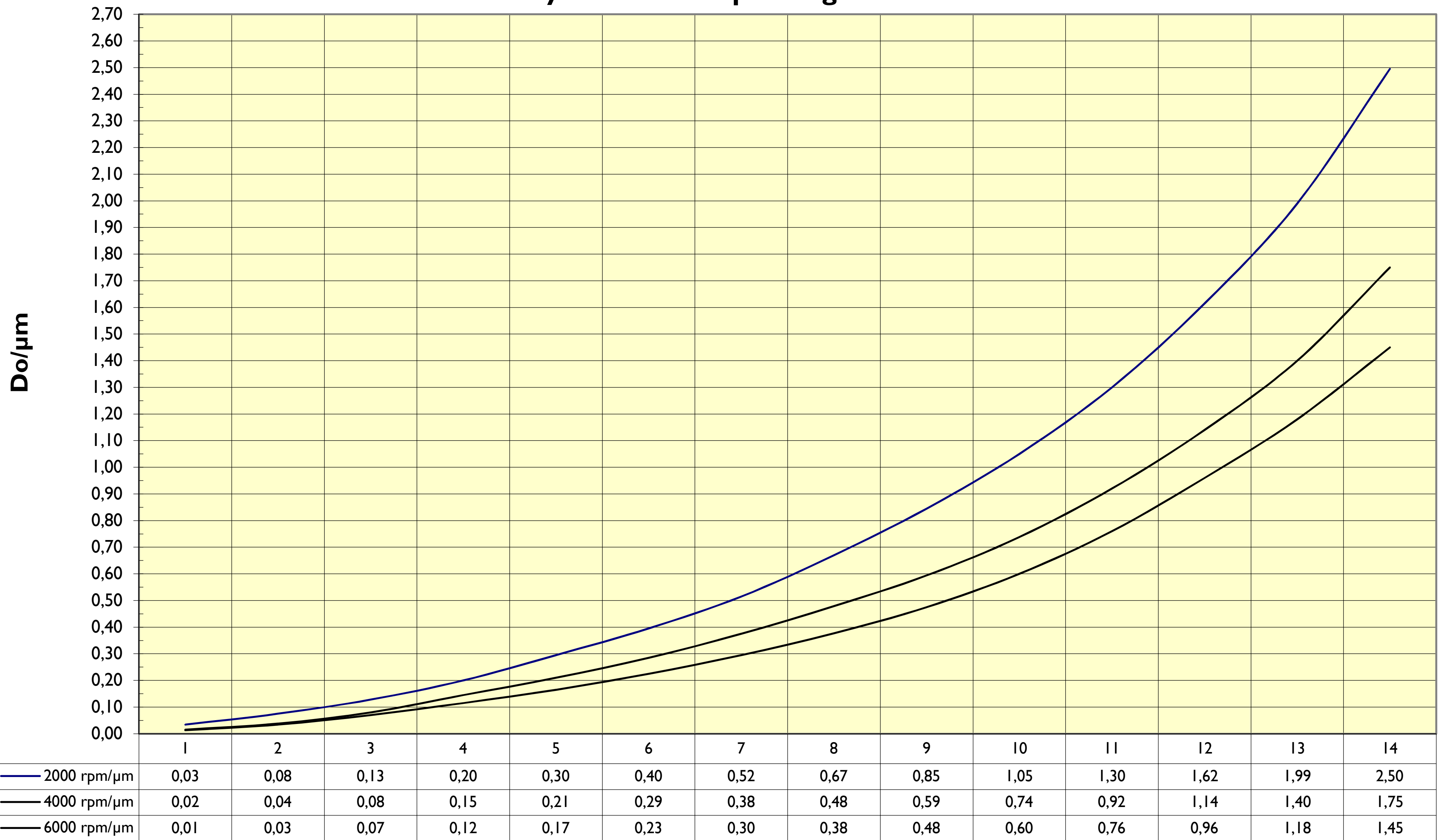
3. Process Description and Storage

• **Coating**	6000 - 2000 rpm in air conditioned working areas at 20 - 25 °C and a humidity of 30 - 50 % (☞ Tab. 1).
• **Baking**	210 ± 2 °C, 60 min convection oven or 200 ± 2 °C, 10 minutes hot plate.
• **Exposure**	With usual devices for e-beam lithography. ☞ A typical dose to clear is about 25 µC/cm² (20 kV, resist thickness 1.0 µm).
• **Development**	2-5 minutes with the **Developers AR 600-50**, **AR 600-55** and **600-56.** ☞ strong undercut patterns are possible by using AR-P 617 as two layer system (first bake of bottom layer: 210 °C, second bake of both layers: 190 °C, removing with AR 300-47, AR 300-70 or 300-73).
• **Stopping**	30 seconds with the **Stopper AR 600-60.**
• **Post bake**	For special processes 30 minutes in a convection oven at 130 °C. ☞ For high etching resistance in wet chemical and plasma chemical etch processes.
• **Cleaning**	Substrates and equipment can be cleaned with **Thinner AR 600-07** or **Remover AR 600-70.**
• **Removing**	Baked PMMA films: **Remover AR 600-70 or AR 300-70** (a stronger remover which can be heated to up to 60 °C in order to enhance effectivity). ☞ Hard-baked films (> 210 °C) require the use of oxidising acids (aqua regia, piranha, warm chromium sulphuric acid solutions), or a treatment with oxygen plasma.
• **Storage**	Functionality guaranteed for 6 months from date of sale if stored dry at a constant temperature between 10 - 22°C.

4. Disposal and Safety References

Liquid or solid wastes have to be disposed at proper deposit places or by controlled combustion in officially authorized plants. Resists and thinner contain organic solvents. Adequate ventilation in the working area is demanded. Avoid direct contact with products and their vapours.
Wear chemical goggles and protective gloves! Please ask for safety data sheets!

As of Jan. 2008

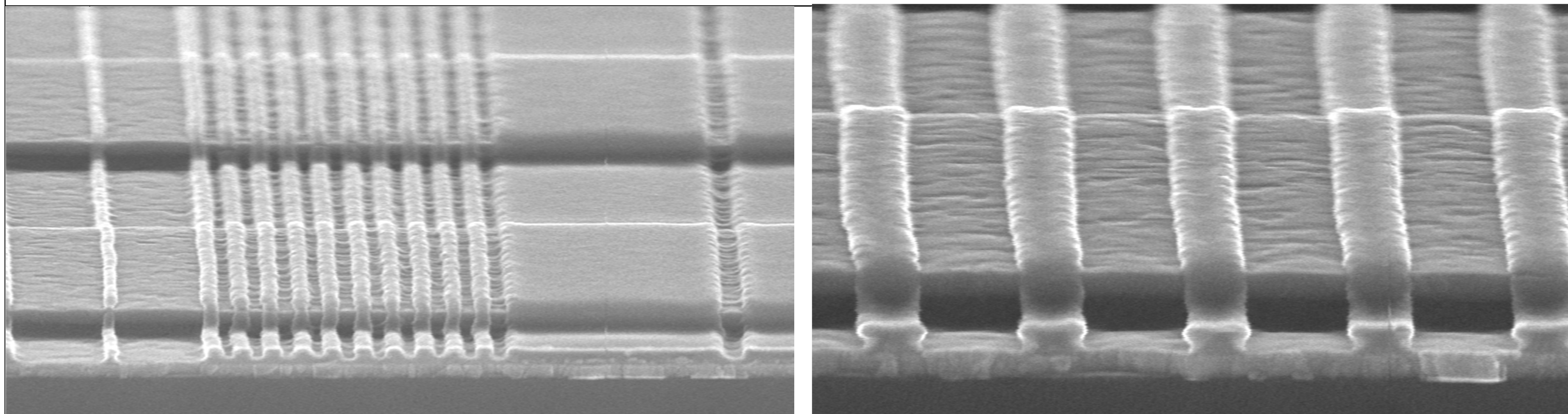


	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2000 rpm/µm	0,03	0,08	0,13	0,20	0,30	0,40	0,52	0,67	0,85	1,05	1,30	1,62	1,99	2,50
4000 rpm/µm	0,02	0,04	0,08	0,15	0,21	0,29	0,38	0,48	0,59	0,74	0,92	1,14	1,40	1,75
6000 rpm/µm	0,01	0,03	0,07	0,12	0,17	0,23	0,30	0,38	0,48	0,60	0,76	0,96	1,18	1,45

Table 1 Spezifications of PMMA-Copolymers PMMA/MA 33% in 1-methoxy-2-propanol

Solvent of Resist	E-Beam Resist AR-P	Solids content [%]	Viskosity 25°C [mPas]	Film thickness 1000 rpm [µm]	Film thickness 2000 rpm [µm]	Film thickness 4000 rpm [µm]	Film thickness 6000 rpm [µm]	Density 20°C [g/cm³]
1-methoxy-2-propanol	**617.03**	**3,0**	**7,1**		**0,13**	**0,09**	**0,08**	**0,965**
	617.06	**6,0**	**19,7**		**0,40**	**0,29**	**0,23**	**0,973**
	617.08	**8,0**	**36,2**		**0,68**	**0,48**	**0,39**	**0,976**
	617.12	12,0	120	2,48	1,62	1,14	0,98	0,988
	617.14	14,0	235		2,50	1,75	1,45	0,994

The bold faced type resists of the series AR-P 617 are standard products, their prices are included in the price list. All the other resists are delivered with a 25% added regular price in comparison with next higher solids content. As of Jan.´12



150-nm-pattern over 200-nm-SiO_2-level generated by AR-P 617.03 (Do = 120 nm); electron exposure: LION LV1 (Leica GmbH, Jena); REM: Institut für Halbleiterphysik, Frankfurt/O. GmbH; publication M.3 MNE´95