Positive Photoresist AR-P 3100

AR-P 3100 photoresist product series for mask production

Adhesion-enhanced positive resists for the production of masks and fine scale divisions

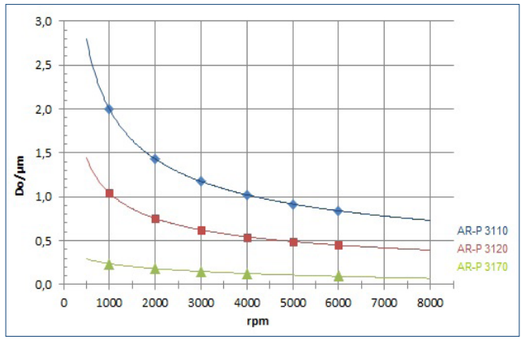
Characterisation

- broadband UV, i-line, g-line
- high photosensitivity, high resolution
- strong adhesion to critical glass/chromium surfaces for extreme stresses during wet-chemical etching processes
- for the production of CD masters and lattice structures
- 3170 also suitable for laser interference lithography
- plasma etching resistant
- combination of novolac and naphthoquinone diazide
- safer solvent PGMEA

Properties I

Parameter / AR-P	3110	3120	3170
Solids content (%)	28	21	7
Viscosity 25 °C (mPas)	12	5	2
Film thickness/ 4000 rpm (nm)	1000	550	120
Resolution (µm)	0.5	0.4	0.4
Contrast	3.0	3.0	3.0
Flash point (°C)	42		
Storage 6 month (°C)	10 - 18		

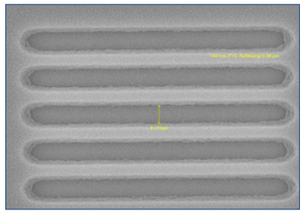
Spin curve



Properties II

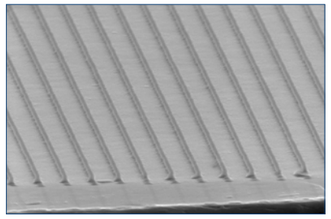
Glass transition temperature	108	
Dielectric constant	3.1	
Cauchy coefficients	N_0	1.621
	N_1	65.6
	N_2	195.6
Plasma etching rates (nm/min) (5 Pa, 240-250 V bias)	Ar-sputtering	7
	O_2	165
	CF_4	38
	80 CF_4 + 16 O_2	89

Structure resolution



AR-P 3120
Film thickness 0.6 µm
Resist structures 0.38 µm L/S

Resist structures



70-nm-lines generated with the AR-P 3170 by laser interference lithography

Process parameters

Substrate	Si 4“ wafer
Tempering	95 °C, 90 s, hot plate
Exposure	i-line stepper (NA: 0.65)
Development	AR 300-47, 1 : 1, 60 s, 22 °C

Process chemicals

Adhesion promoter	AR 300-80
Developer	AR 300-35, AR 300-47
Thinner	AR 300-12
Remover	AR 300-76, AR 300-73

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Process conditions

This diagram shows exemplary process steps for AR-P 3100 resists. All specifications are guideline values which have to be adapted to own specific conditions. For further information on processing, ☞ “Detailed instructions for optimum processing of photoresists”. For recommendations on waste water treatment and general safety instructions, ☞ ”General product information on Allresist photoresists”.

	AR-P 3110	AR-P 3120	AR-P 3170
Coating	4000 rpm, 60 s 1000 nm	4000 rpm, 60 s 550 nm	4000 rpm, 60 s 120 nm
Tempering (+/- 1 °C)	100 °C, 1 min hot plate or 95 °C, 25 min convection oven		
UV exposure	Broadband UV, 365 nm, 405 nm, 436 nm Exposure dose (E_0, broadband UV stepper):		
	45 mJ/cm²	40 mJ/cm²	40 mJ/cm²
Development (21-23 °C ± 0,5 °C) puddle	AR 300-35, 1 : 3, 60 s	AR 300-47, 1 : 1, 60 s	AR 300-47, 1 : 1,5, 60 s
Rinse	DI-H_2O, 30 s		
Post-bake (optional)	115 °C, 1 min hot plate or 115 °C, 25 min convection oven		
Customer-specific technologies	Generation of e.g. semi-conductor properties		
Removal	AR 300-70 or O_2 plasma ashing		

Development recommendations

Resist / Developer	AR 300-26	AR 300-35	AR 300-47
AR-P 3110	1 : 3	pure to 3 : 2	1.5 : 1
AR-P 3120	1 : 3	5 : 1	1 : 1
AR-P 3170	1 : 4	1 : 1	1 : 1,5

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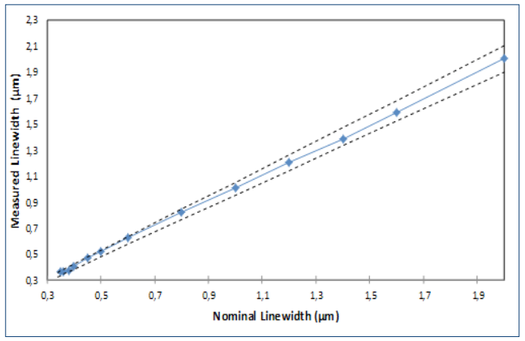
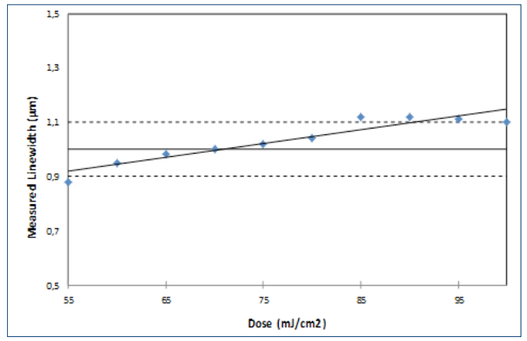
Linearity



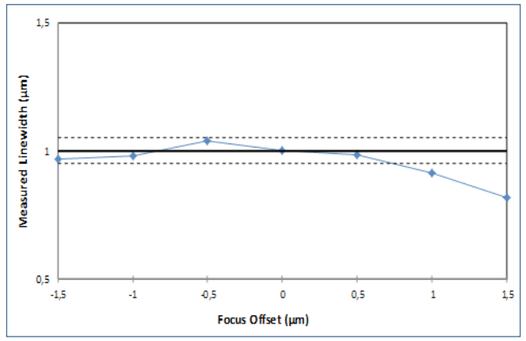
Up to a structure width of 0.38, a very good agreement is obtained. REM measurement: Thickness 560 nm, i-line stepper (NA: 0.65 NA), Developer AR 300-47 1 : 1.

Optimum exposure dose



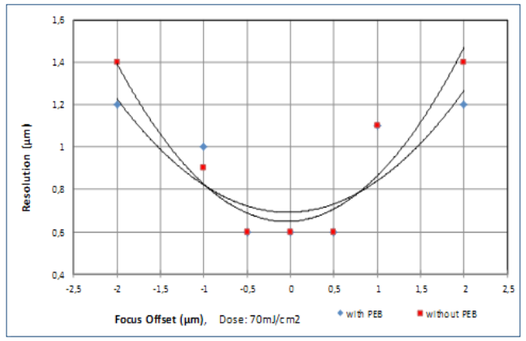
Underexposure leads in the case of complete development (more than 55 ml/cm²) to narrower trenches, while overexposure results in a widening of trenches.

Focus variation



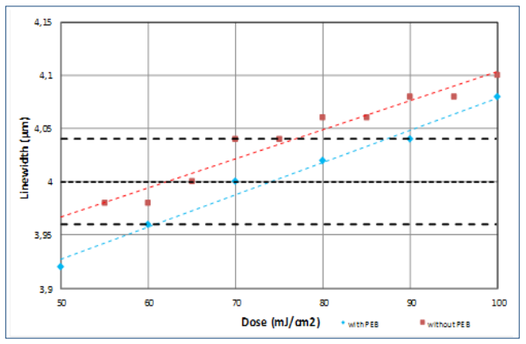
The intended structure sizes can here be realised by varying the focus between -1.5 to 0.8 (parameter see grafic linearity).

Focus variation (with and without PEB)



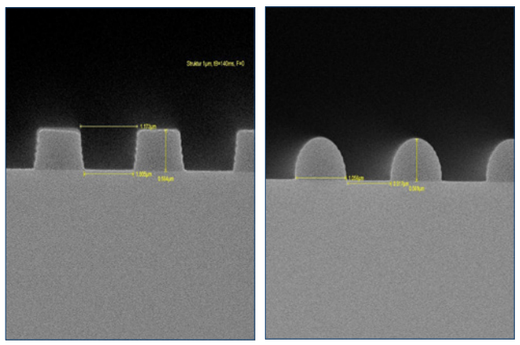
Without PEB, a higher resolution is obtained since the focus curve is steeper (PEB, 90 °C, 60 s).

Optimum exposure dose



Optimum dose, with hard bake (110 °C) and without hard bake. The additional hard bake requires 15 % more light (PEB, 90 °C, 60 s).

Thermal properties of resist structures



Untempered

Hard bake 110 °C

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