Positive Photoresist AR-P 3200

AR-P 3200 photoresist series for high film thicknesses

Thick positive resists for electroplating and microsystems technology

Characterisation

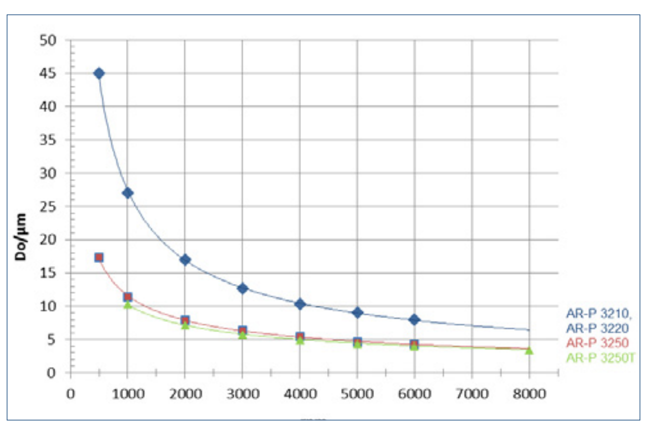
- broadband UV, i-line, g-line
- high photosensitivity, high resolution
- profiles with high edge steepness dimens. accuracy
- plasma etch resistant, electroplating-stable
- 3210/3250 for film thicknesses up to 40 µm/20 µm
- 3220 transparent for thick films up to 100 µm in multiple coating steps, 100 µm development in one step
- combination of novolac and naphthoquinone diazide
- safer solvent PGMEA

Properties I

Parameter / AR-P	3210	3220	3250(T)
Solids content (%)	47	47	39
Viscosity 25 °C (mPas)	1990	1820	250
Film thickness/ 4000 rpm (µm)	10	10	5
Resolution (µm)	4.0	3.0	1.2
Contrast	2.0	2.0	2.5
Flash point (°C)	42		
Storage temperature (°C)*	10 - 18		

* Products have a guaranteed shelf life of temperatures from the date of sale if stored correctly and can also be used without guarantee until the date indicated on the label.

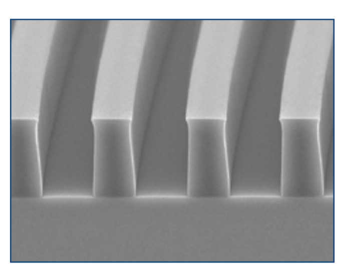
Spin curve



Properties II

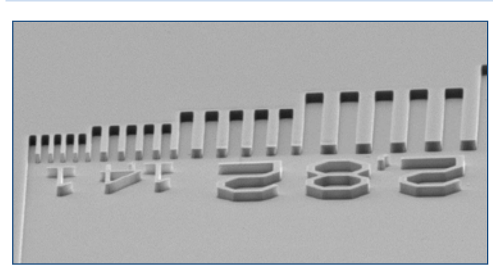
Property		
Glass transition temperature	108	
Dielectric constant	3.1	
Cauchy coefficients AR-P 3210	N_0	1.597
	N_1	79.5
	N_2	105.1
Plasma etching rates (nm/min) (5 Pa, 240-250 V bias)	Ar-sputtering	7
	O_2	170
	CF_4	39
	80 CF_4 + 16 O_2	90

Structure resolution



AR-P 3210
Film thickness 12 µm
Resist structures 4 µm

Resist structures



AR-P 3220
Film thickness 25 µm

Process parameters

Substrate	Si 4“ wafer
Tempering	95 °C, 10-15 min, hot plate
Exposure	Maskaligner MJB 3, contact exposure
Development	AR 300-26, 1 : 3, 3 min, 22 °C

Process chemicals

Adhesion promoter	AR 300-80
Developer	AR 300-26
Thinner	AR 300-12
Remover	AR 300-76, AR 600-71

Innovation
Creativity
Customer-specific solutions

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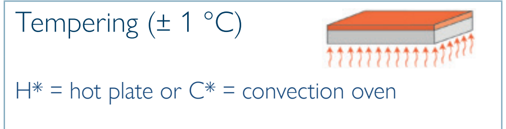
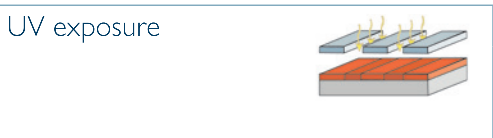
Process conditions

This diagram shows exemplary process steps for AR-P 3200 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".

Coating	AR-P 3210	AR-P 3220	AR-P 3250	AR-P 3250T
	4000 rpm, 90 s 10 µm	600 rpm, 120 s; 30 µm	4000 rpm, 60 s; 5.0 µm	4000 rpm, 60 s; 5.0 µm
Tempering (± 1 °C)  H* = hot plate or C* = convection oven	H* 95 °C, 4 min	95 °C, 15 min	95 °C, 2 min	95 °C, 2 min
	C* 90 °C, 40 min	90 °C, 90 min	90 °C, 30 min	90 °C, 30 min
UV exposure 	Broadband UV, 365 nm, 405 nm, 436 nm			
	Exposure dose (E_0, broadband UV stepper):			
	450 mJ/cm²	900 mJ/cm²	220 mJ/cm²	300 mJ/cm²
Development (21-23 °C ± 0,5 °C) puddle	AR 300-26, 1 : 2 2 min	AR 300-26, undil.; 3 min	AR 300-26, 3 : 2; 2 min	AR 300-44, pur; 2 min
Rinse	DI-H_2O, 30 s			
Post-bake (optional)	Not required			
Customer-specific technologies	Generation of e.g. semi-conductor properties, galvanic, MEMS			
Removal	AR 300-76 or O_2 plasma ashing			

Processing instructions (for the processing of thick films > 40 µm)

Coating: Coating should be performed in two or several steps using the same procedure. After a low initial spin speed (30 s), a main spin speed of 250 – 500 rpm for at least 2-5 min should be chosen. A brief subsequent spinning off at 600 – 800 rpm for 5 s reduces edge bead formation.

Tempering: Tempering should be performed in 2 steps: 1. 75 °C, 5 min hot plate or 70 °C, 30 min convection oven; 2. 90 °C, 20 min hot plate or 90 °C, 80 min convection oven. After tempering, a slow cooling is recommended to avoid stress cracks.

Development recommendations

Resist / Developer	AR 300-26	AR 300-35	AR 300-44
AR-P 3210 (up to 20 µm)	1 : 2 to 1 : 3 (2-10 min)	undil. up to 10 µm (2-10 min)	-
AR-P 3220 (up to 20 µm)	3 : 1 to 2 : 1 (2-5 min)	-	-
AR-P 3250 (up to 10 µm)	2 : 1 to 3 : 2 (1-5 min)	-	-
AR-P 3250T (up to 5 µm)	-	-	undil. up to 5 µm (1-5 min)

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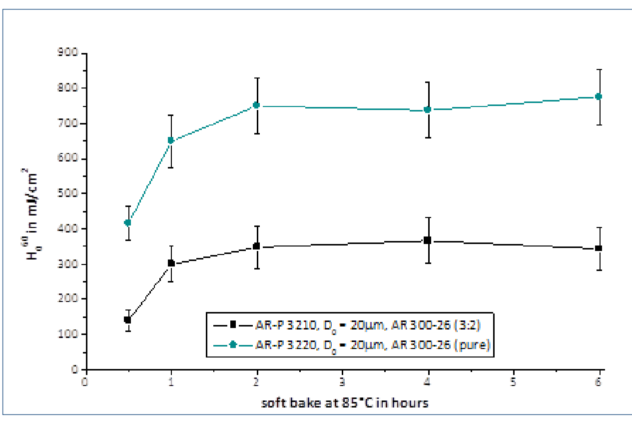
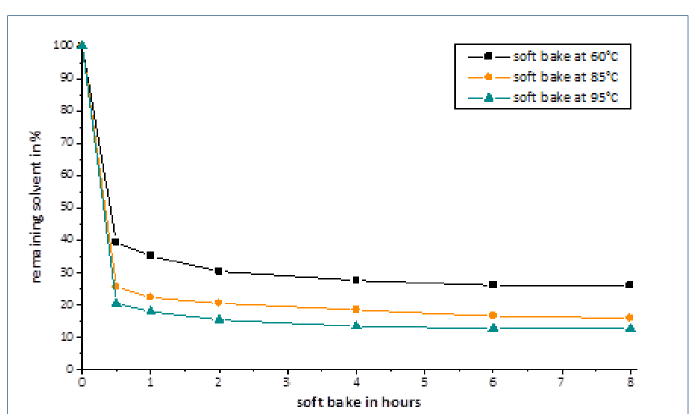
Sensitivity vs. duration of the soft bake



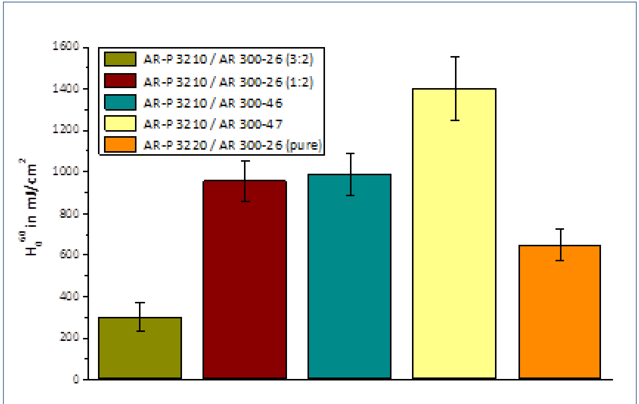
After 2 hours, the sensitivity remains more or less constant (broadband UV, resist thickness 20 µm).

Residual solvent after tempering



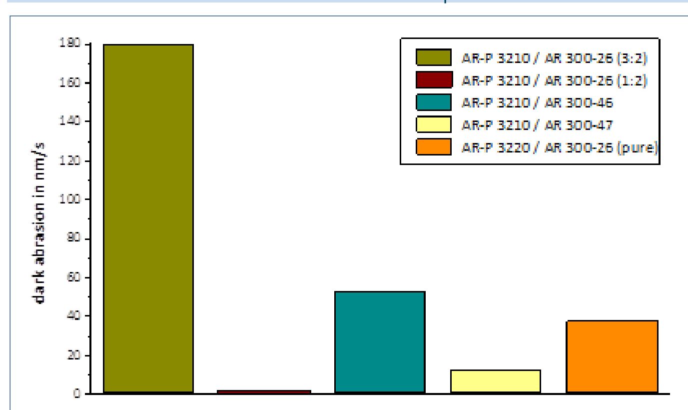
After a bake at 95 °C, approx. 7 % of the solvent remain in the layer (initial solids content: 47 %)

Sensitivity in different developers



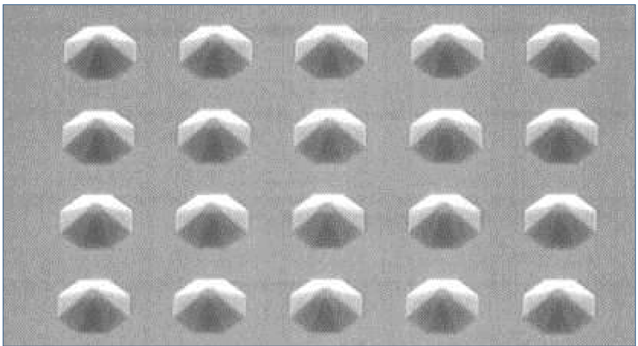
Film thickness 20 µm, soft bake 85 °C, 1 h convection oven, bb UV

Dark erosion in different developers



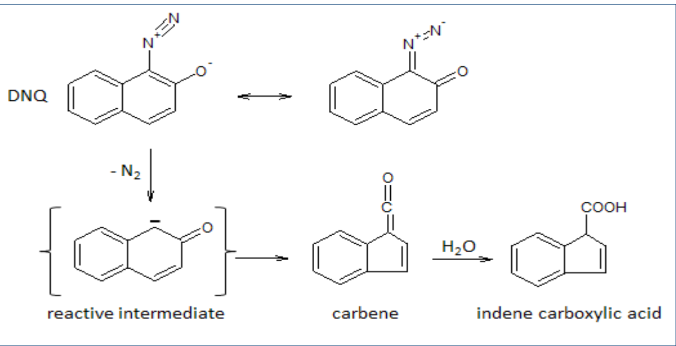
Erosion corresponding to determined sensitivities

Grey tone mask lithography



28 µm-high 3D pyramids with AR-P 3220

Photolysis of photo-active compound (PAC)



Chemical reaction for bleaching and full exposure of the layer (Süss-reaction)

The transparency of AR-P 3220 is higher as compared to AR-P 3210, due to the lower concentration of the PAC. The gradation is accordingly relatively low. This fact can be used for the fabrication of three-dimensional structures using grey tone masks with AR-3220. Different exposure doses will result in different resist film thicknesses.