Positive Photoresist AR-P 3200

AR-P 3200 photoresist series for high film thicknesses

Thick positive resists for electroplating and microsystems technology

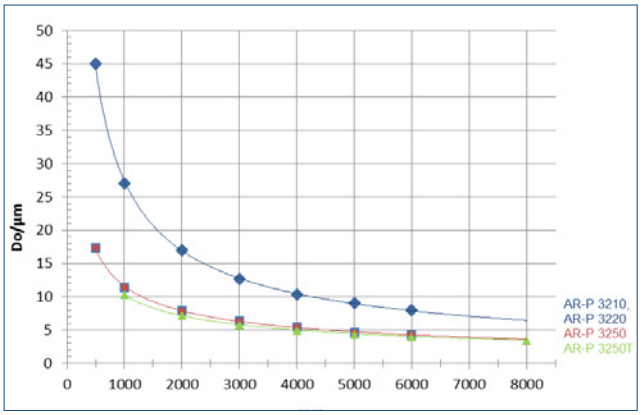
Characterisation

- 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 6 month (°C)	10 - 18		

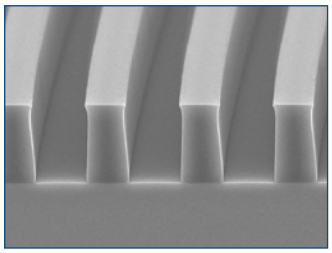
Spin curve



Properties II

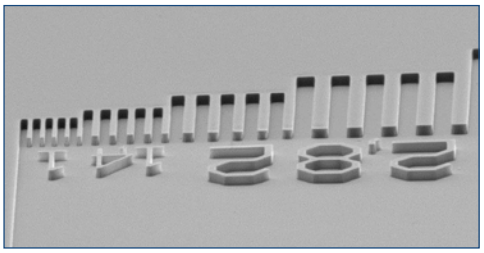
Glass transition temperature	108	
Dielectric constant	3.1	
Cauchy coefficients AR-P 3210	N_0	1.597
	N_1	79.5
	N_2	105.1
Plasma etching rates (nm/min) (5 Pa, 240-250 V bias)	Ar-sputtering	7
	O_2	170
	CF_4	39
	80 CF_4 + 16 O_2	90

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

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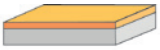
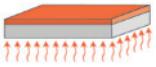
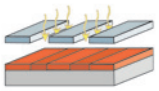
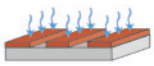
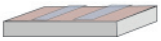
Process conditions

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".

		AR-P 3210	AR-P 3220	AR-P 3250	AR-P 3250T
Coating 		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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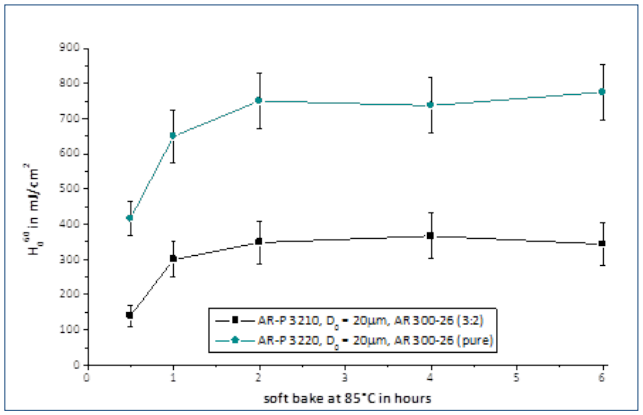
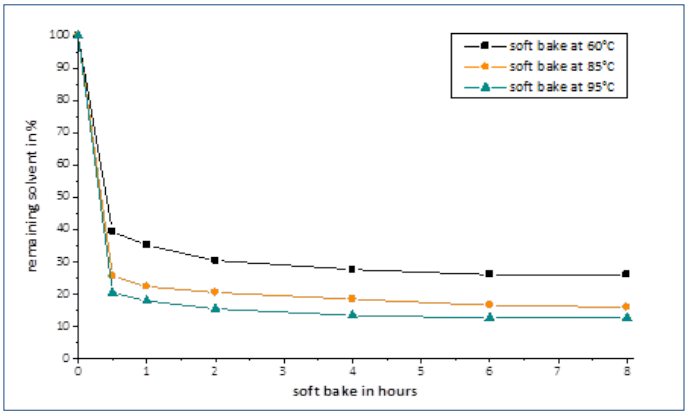
Sensitivity vs. duration of the soft bake



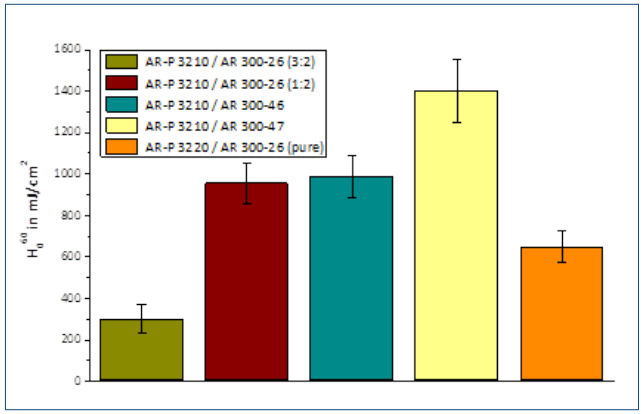
After 2 hours, the sensitivity remains more or less constant (broadband UV, resist thickness 20 µm).

Residual solvent after tempering



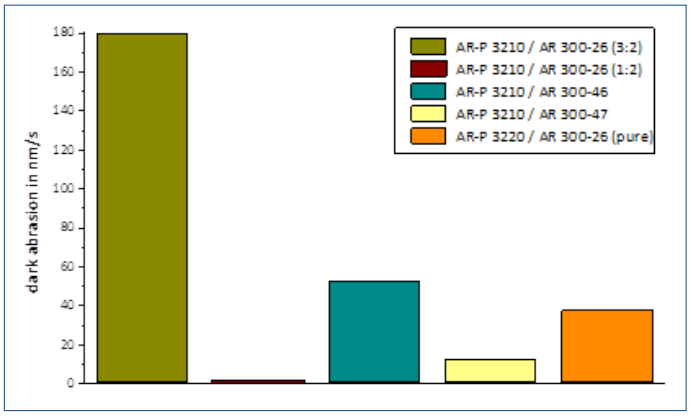
After a bake at 95 °C, approx. 7 % of the solvent remain in the layer (initial solids content: 47 %)

Sensitivity in different developers



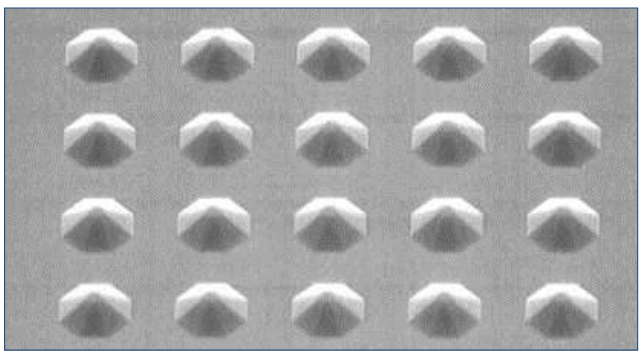
Film thickness 20 µm, soft bake 85 °C, 1 h convection oven, bb UV

Dark erosion in different developers



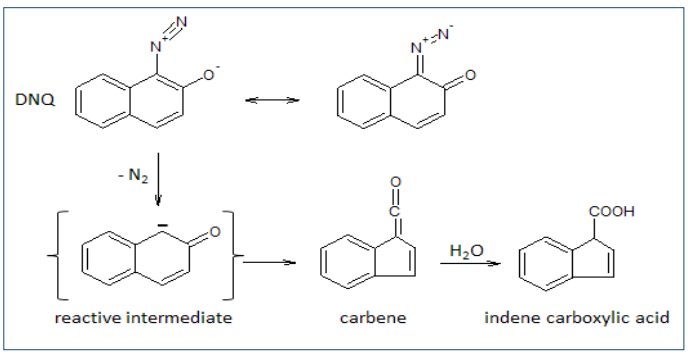
Erosion corresponding to determined sensitivities

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.