Innovation
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Customer-specific solutions

Negative Photoresist AR-N 4300

AR-N 4340 photoresist for the mid UV range

Highly sensitive negative resist for the production of integrated circuits

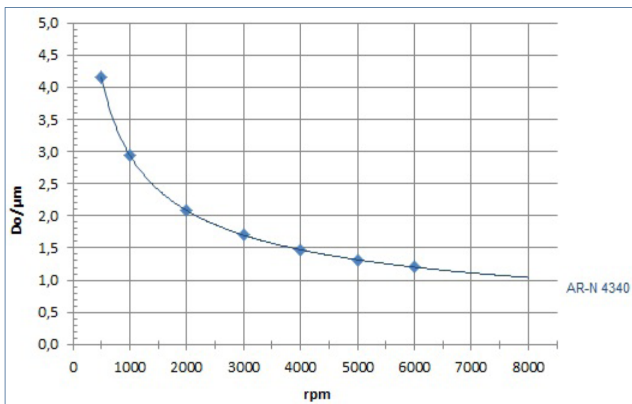
Characterisation

- i-line, g-line
- highest sensitivity, excellent resolution
- good adhesion, high contrast, chemically enhanced
- undercut profiles (lift-off) are possible
- plasma etching resistant, temperature-stable up to 220 °C after subsequent treatment
- novolac with photochemical acid generator and amine-based crosslinking agent
- safer solvent PGMEA

Properties I

Parameter / AR-N	4340
Solids content (%)	32
Viscosity 25 °C (mPas)	18
Film thickness/4000 rpm (µm)	1.4
Resolution (µm)	0.5
Contrast	5.0
Flash point (°C)	42
Storage 6 month (°C)	10 - 18

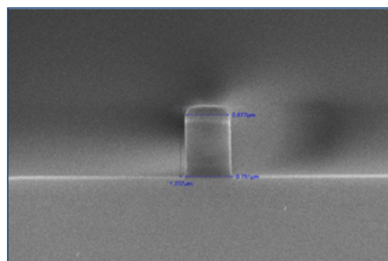
Spin curve



Properties II

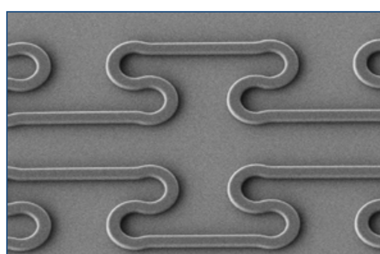
Glass transition temperature	102		
Dielectric constant	3.1		
Cauchy coefficients unexposed / exposed	N_0	1.593	1.599
	N_1	75.4	81.4
	N_2	80.0	81.4
Plasma etching rates (nm/min) (5 Pa, 240-250 V Bias)	Ar-sputtering	8	
	O_2	173	
	CF_4	33	
	80 CF_4 + 16 O_2	93	

Structure resolution



AR-N 4340
Film thickness 1.4 µm
Resist structure 0.7 µm L/S

Resist structures



AR-N 4340
Film thickness 2.0 µm
Resist structure 4.0 µm

Process parameters

Substrate	Si 4“ wafer
Tempering	85 °C, 60 s, hot plate
Exposure	i-line stepper (NA: 0.65)
Development	AR 300-475, 60 s, 22 °C

Process chemicals

Adhesion promoter	AR 300-80
Developer	AR 300-475
Thinner	AR 300-12
Remover	AR 300-76, AR 300-72

Negativ-Photoresist AR-N 4300

Process conditions

This diagram shows exemplary process steps for resist AR-N 4340. 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".

Process step	AR-N 4340
Coating	4000 rpm, 60 s 1.4 µm
Softbake (± 1 °C)	90 °C, 1 min hot plate or 85 °C, 25 min convection oven
UV exposure	Broadband UV, 365 nm, 405 nm, 436 nm Exposure dose (E_0, broadband UV stepper): 140 mJ/cm^2,1.4 µm
Crosslinking bake (± 1 °C)	95 °C, 2 min hot plate or 90 °C, 25 min convection oven
Development (21-23 °C ± 0,5 °C) puddle	Note: By extending the development time, an undercut (lift-off) of the resist structure can be obtained at minimum possible exposure dose AR 300-475, 60 s
Rinse	DI-H_2O, 30 s
Hardening of structures up to 300 °C (optional)	Flood exposure 150 mJ/cm^2, bake 115 °C, 1 min hot plate
Customer-specific technologies	Generation of e.g. semiconductor properties or lift-off
Removal	AR 300-76 or O_2 plasma ashing

TCD vs. bake temperature

Temperature °C	TCD [s]	Dose [mJ/cm^2]
70	20	480
80	22	250
90	24	140
100	41	65
110	80	55
120	210	220
130	∞	∞

Development recommendations

Developer	AR 300-26	AR 300-35	AR 300-40
AR-N 4340	1 : 1	undil.	300-475

Samples were dried at 85 °C and crosslinked at temperatures as indicated (developer: AR 300-475).

The development strongly depends on the bake temperature. Above a temperature of 130 °C, resist AR-N 4340 is not developable any more. Optimum temperatures range between 90 and 100 °C.

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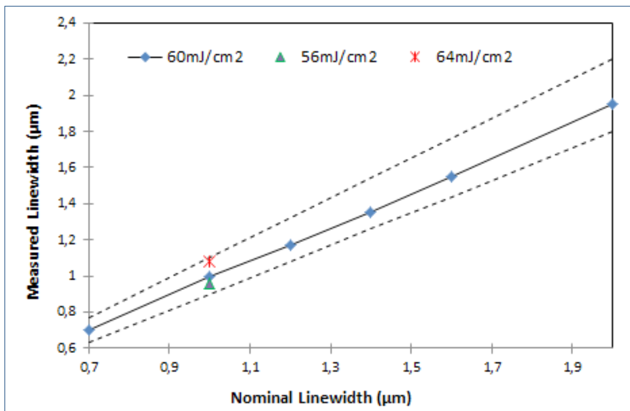
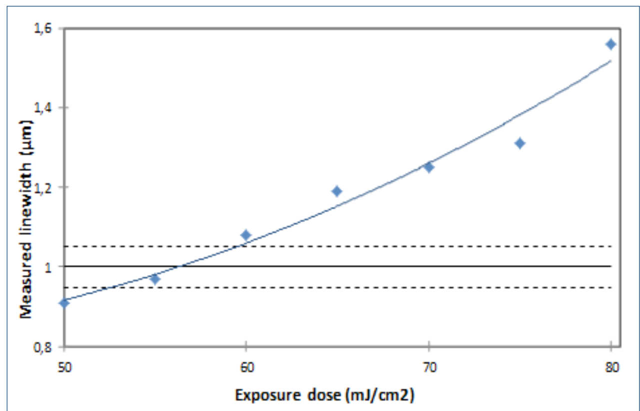
Linearity



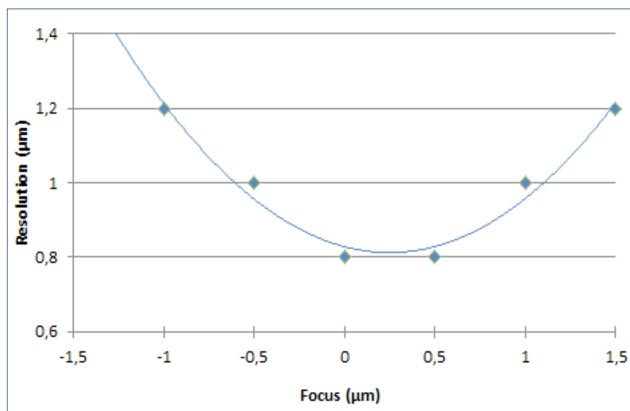
Up to a line width of 0.7 µm, the linearity is in the desired range (parameter see grafic Focus variation).

Optimum exposure dose



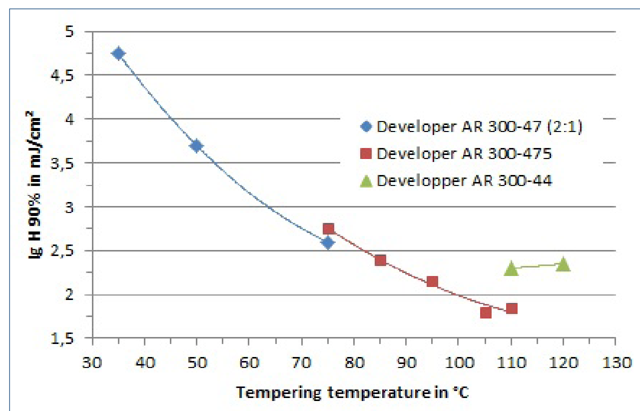
The optimum exposure dose for 1 µm-bars is 56 mJ/cm² (parameter see grafic Focus variation).

Focus variation



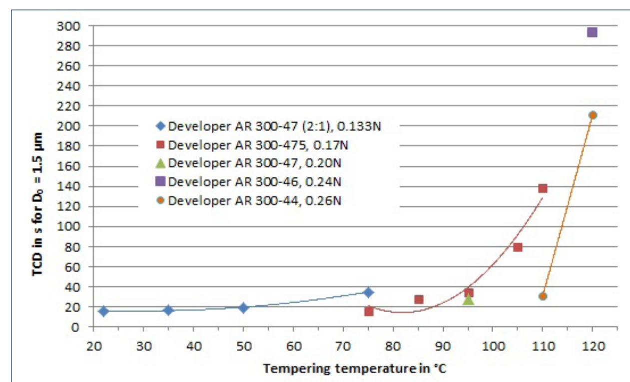
The resist achieves a resolution of 0.8 µm optimal focus adjustment REM measurement: Thickness 1,5 µm, PEB 105 °C, 180 s, I-line stepper (NA: 0,65), Developer AR 300-475.

Sensitivity in dependency on the bake



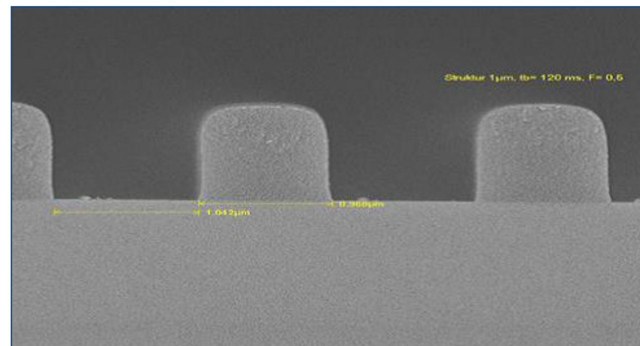
Samples were both dried and crosslinked at temperatures as indicated. The optimum working range is between 90 and 110 °C.

Time for complete development vs. bake



The time for complete development is very short at bake temperatures of < 50 °C, even if weak developers are used. With increasing temperature, the time for complete development (TCD) is considerably prolonged. Above a temperature of 120 °C, complete development of the resist is no longer possible.

Temperature stability after hardening



Hardened resist bar structures after tempering at 200 °C

The developed structures are stable between 140 -160 °C, depending on the drying procedure (hot plate or oven). Structures can be stabilized up to temperatures of 220 °C by flood exposure and a subsequent bake at 120 °C.