

Negative Photoresist AR-N 4200

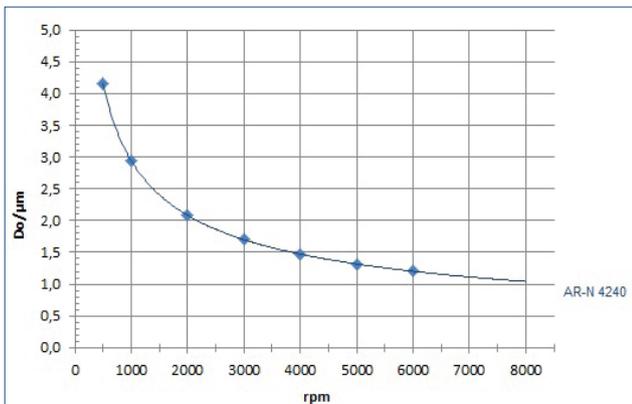
AR-N 4240 Negative Photoresist for the mid and deep UV range

Sensitive negative resist for the production of integrated circuits

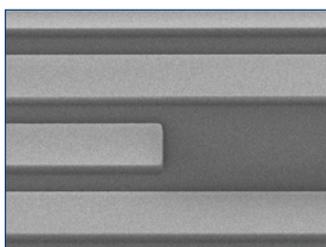
Characterisation

- deep UV, i-line
- high sensitivity, high resolution
- good adhesion, wide process range
- undercut profiles (lift-offs) are possible
- not chemically enhanced
- plasma etching resistant, temperature-stable
- novolac with photoactive crosslinking agent
- safer solvent PGMEA

Spin curve



Structure resolution



AR-N 4240
0.8 µm trenches at a film
thickness of 1.1 µm

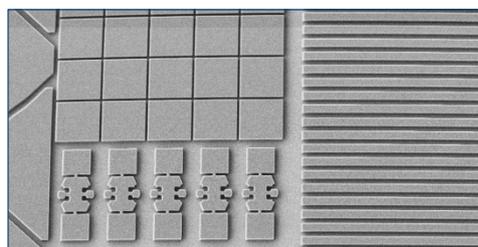
Properties I

Parameter / AR-N	4240
Solids content (%)	30
Viscosity 25°C (mPas)	10
Film thickness/4000 rpm (µm)	1.4
Resolution (µm)	0.6
Contrast	2.8
Flash point (°C)	42
Storage 6 month (°C)	14 - 20

Properties II

Glass transition temperature	102		
Dielectric constant	3.1		
Cauchy coefficients unexposed / exposed	N ₀	1.610	1.609
	N ₁	82.4	88.0
	N ₂	93.0	85.8
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	91	

Resist structures



AR-N 4240
Test structures on
2.0 µm-thick film

Process parameters

Substrate	Si 4" wafer
Tempering	85 °C, 60 s, hot plate
Exposure	i-line stepper (NA: 0.65)
Development	AR 300-47, 60 s, 22 °C

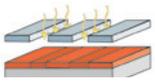
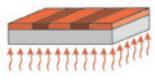
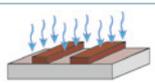
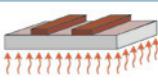
Process chemicals

Adhesion promoter	AR 300-80
Developer	AR 300-47, 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-N 4240 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".

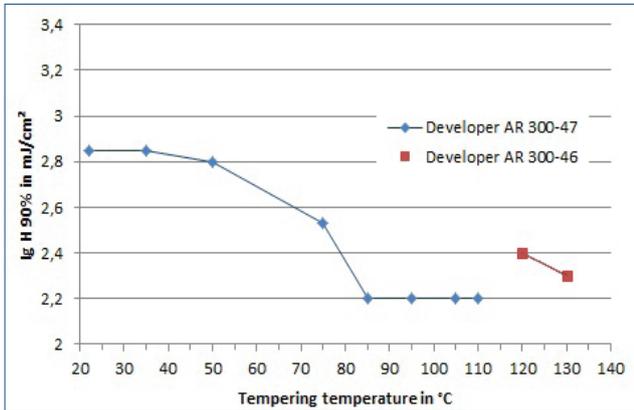
Coating		AR-N 4240 4000 rpm, 60 s 1.4 µm
Tempering ($\pm 1^\circ\text{C}$)		90 °C, 1 min hot plate or 85 °C °C, 25 min convection oven
UV exposure		i-line stepper (broadband UV, 365 nm) Exposure dose (E_0 , i-line stepper): 340 mJ/cm ² , 1.4 µm
Crosslinking bake ($\pm 1^\circ\text{C}$) (optional)		85 °C, 2 min hot plate or 80 °C, 25 min convection oven to increase the sensitivity slightly
Development (21-23 °C \pm 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 300-47, 90 s
Rinse		DI-H ₂ O, 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. semiconductor properties or lift-off
Removal		AR 300-76 or O ₂ plasma ashing

Development recommendations

Resist / Developer	AR 300-26	AR 300-47
AR-N 4240	1 : 1	undil.

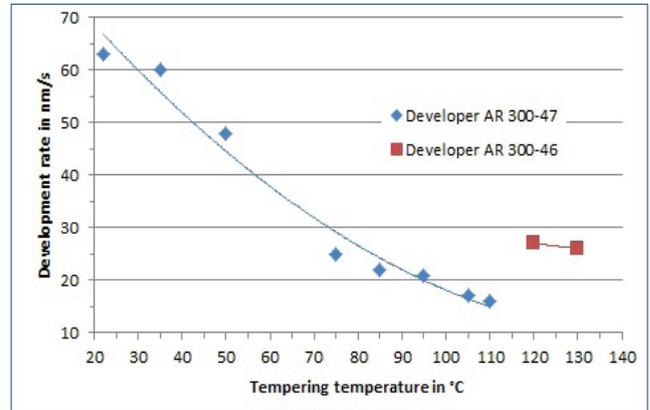
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Sensitivity vs. softbake



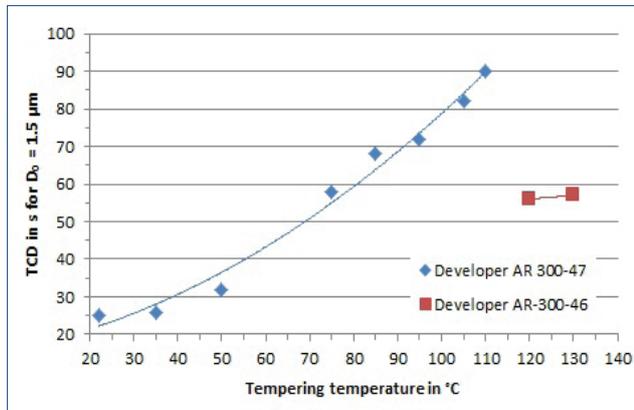
In a range between 85 to 110 °C, the sensitivity remains more or less constant which indicates a stable process for this resist. Above temperatures of 105 °C, the crosslinking agent slowly begins to disintegrate (i-line stepper, thickness 1,4 µm)

Development rate vs. soft bake



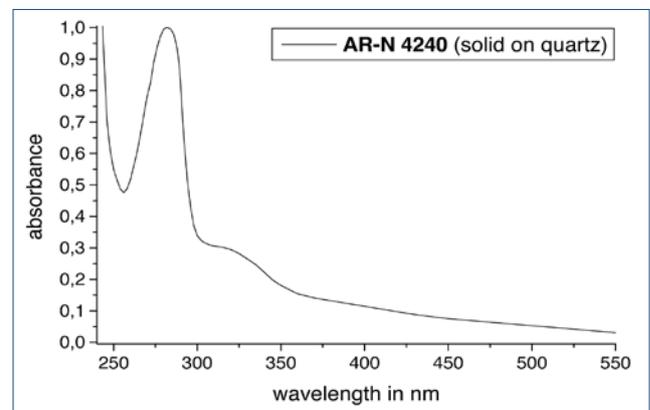
The development rate more or less decreases constantly up to 110 °C. The stronger developer AR 300-46 increases the development rate again, despite the higher temperature.

Time for complete development



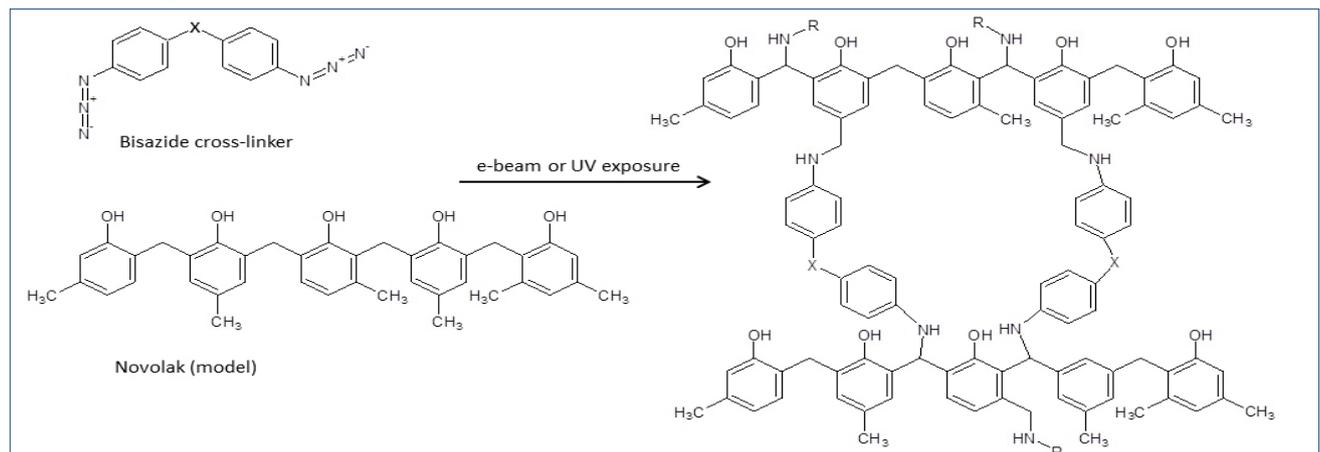
At a recommended softbake temperature of 85 °C, the time for complete development is approx. 70 s. A faster development requires the stronger developer AR 300-46.

Absorption curve



Absorption up to 280 nm is mainly due to the novolac. The bisazide absorbs up to 380 nm and the resist is thus optimally suited for i-line.

Crosslinking reaction, no CAR



Novolac molecules are connected via bisazide molecules