

## Negative Photoresist AR-N 4300

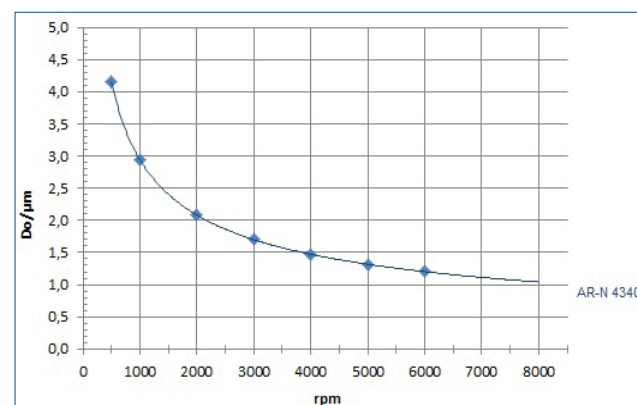
### AR-N 4340 photoresist for the mid UV range

Highly sensitive negative resist for the production of integrated circuits

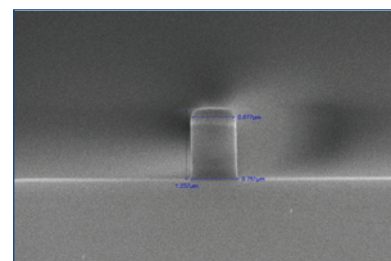
#### Characterisation

- 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

#### Spin curve



#### Structure resolution



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

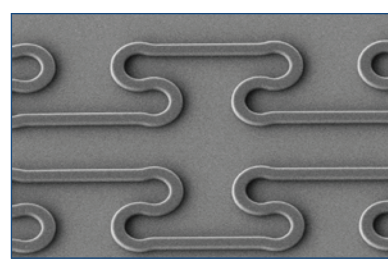
#### Properties I

Parameter / AR-N	4340
Solids content (%)	32
Viscosity 25 °C (mPas)	9
Film thickness/4000 rpm (μm)	1.4
Resolution (μm)	0.5
Contrast	5.0
Flash point (°C)	42
Storage 6 month (°C)	10 - 18

#### Properties II

Glass transition temperature	102		
Dielectric constant	3.1		
Cauchy coefficients unexposed / exposed	N <sub>0</sub>	1.593	1.599
	N <sub>1</sub>	75.4	81.4
	N <sub>2</sub>	80.0	81.4
Plasma etching rates (nm/min) (5 Pa, 240-250 V Bias)	Ar-sputtering	8	
	O <sub>2</sub>	173	
	CF <sub>4</sub>	33	
	80 CF <sub>4</sub> + 16 O <sub>2</sub>	93	

#### 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".

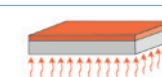
#### Coating



#### AR-N 4340

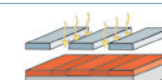
4000 rpm, 60 s  
1.4 μm

#### Softbake (± 1 °C)



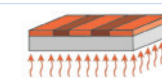
90 °C, 1 min hot plate or  
85 °C, 25 min convection oven

#### UV exposure



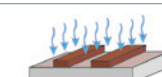
Broadband UV, 365 nm, 405 nm, 436 nm  
Exposure dose (E<sub>0</sub>, broadband UV stepper): 140 mJ/cm<sup>2</sup>, 1.4 μm

#### 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  
DI-H<sub>2</sub>O, 30 s

#### Rinse

#### Hardening of structures up to 300 °C (optional)

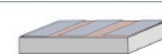
Flood exposure 150 mJ/cm<sup>2</sup>, bake 115 °C, 1 min hot plate

#### Customer-specific technologies



Generation of e.g. semiconductor properties or lift-off

#### Removal



AR 300-76 or O<sub>2</sub> plasma ashing

### TCD vs. bake temperature

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

### Development recommendations

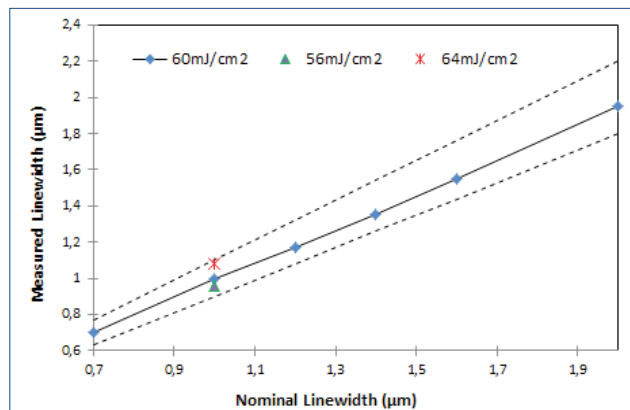
Developer	AR 300-26	AR 300-35	AR 300-40
AR-N 4340	1 : 1	undil.	300-475

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.

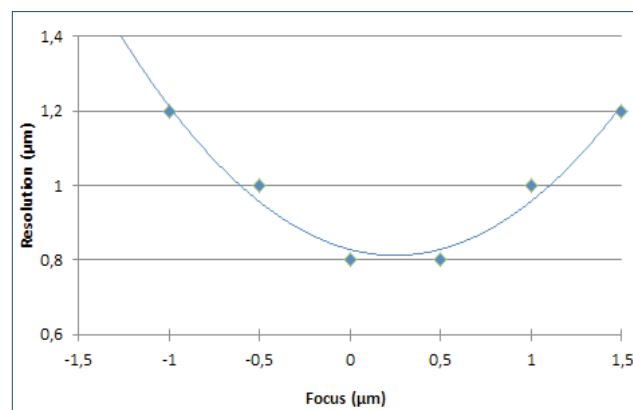
## Negative Photoresist AR-N 4300

### Linearity



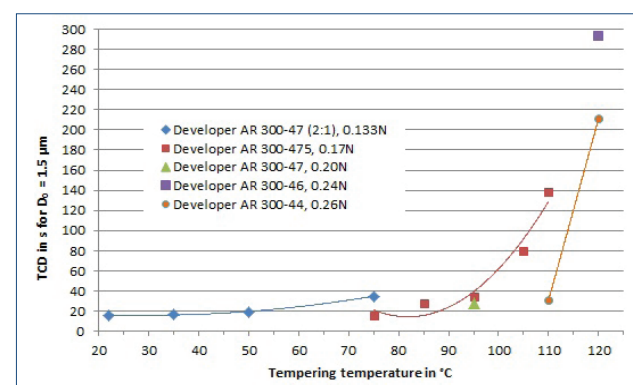
Up to a line width of 0.7 µm, the linearity is in the desired range (parameter see graphic Focus variation).

### Focus variation



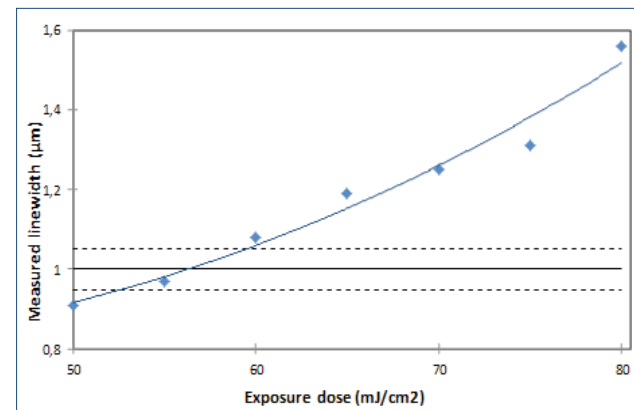
The resist achieves a resolution of 0.8 µm optimal focus adjustment REM measurement: Thickness 1.5 µm, PEB 105 °C, 180 s, I-line stepper (NA: 0.65), Developer AR 300-475.

### Time for complete development vs. bake



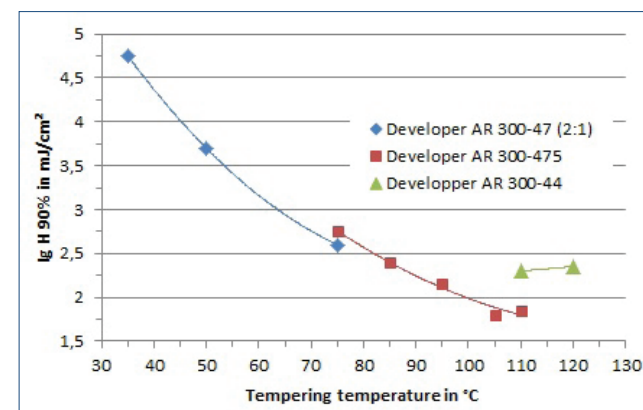
The time for complete development is very short at bake temperatures of < 50 °C, even if weak developers are used. With increasing temperature, the time for complete development (TCD) is considerably prolonged. Above a temperature of 120 °C, complete development of the resist is no longer possible.

### Optimum exposure dose



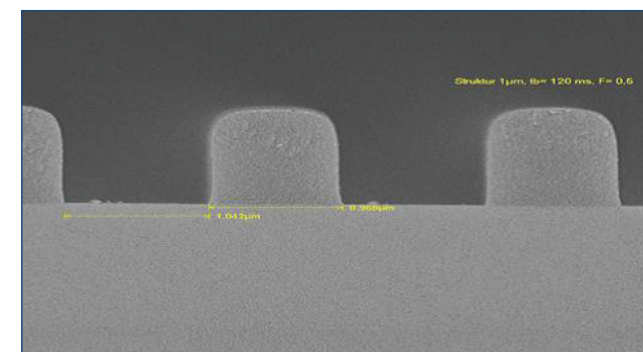
The optimum exposure dose for 1 µm-bars is 56 mJ/cm² (parameter see graphic Focus variation).

### 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.

### 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.