

Positive Photoresists AR-P 3500 / 3500 T

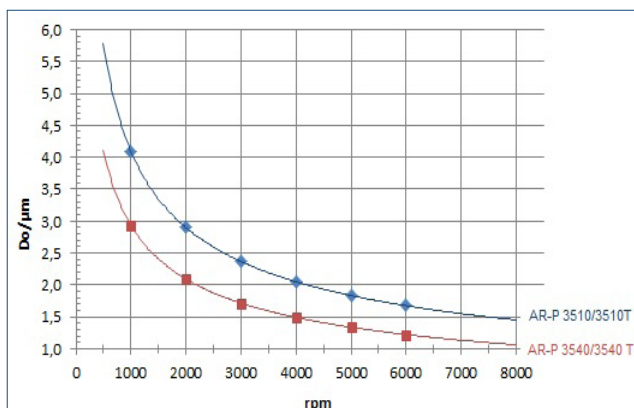
AR-P 3500 (T) photoresist series with wide process range

Sensitive positive-tone standard resists for the production of integrated circuits

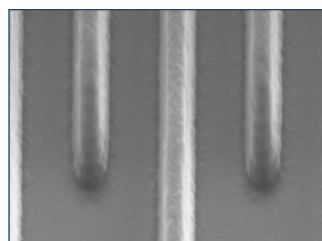
Characterisation

- broadband UV, i-line, g-line
- high photosensitivity, high resolution
- very good adhesion properties
- 3500 T: robust processing, suitable for TMAH developer 0.26 n
- plasma etching resistant, temperature-stable up to 120 °C
- combination of novolac and naphthoquinone diazide
- safer solvent PGMEA

Spin curve



Structure resolution



AR-P 3540 T
Film thickness 1.5 μm
Resist structures 0.5 μm

Process parameters

Substrate	Si 4" wafer
Tempering	95 °C, 90 s, hot plate
Exposure	g-line stepper (NA: 0.56)
Development	AR 300-44, 60 s, 22 °C

Properties I

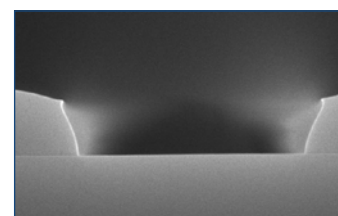
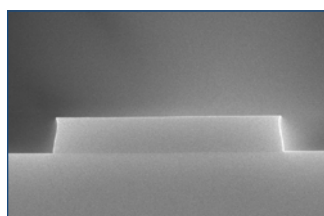
Parameter / AR-P	3510 / 3510 T	3540 / 3540 T
Solids content (%)	35 / 32	31 / 28
Viscosity 25 °C (mPas)	33 / 38	18 / 21
Film thickness / 4000 rpm (μm)	2.0	1.4
Resolution (μm)	0.8 / 0.6	0.7 / 0.5
Contrast	4.0 / 4.5	4.5 / 5.0
Flash point (°C)	42	
Storage temperature (°C)*	10 - 18	

* 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.

Properties II

Glass transition temperature	108	
Dielectric constant	3.1	
Cauchy coefficients AR-P 3540 T	N ₀	1.627
	N ₁	71.4
	N ₂	164.8
Plasma etching rates (nm/min) (5 Pa, 240-250 V bias)	Ar-sputtering	7
	O ₂	165
	CF ₄	37
	80 CF ₄ + 16 O ₂	88

Temperature stability



Structures without hard bake and with tempering at 140 °C (hot plate, 1 mm) with AR-P 3540

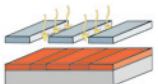
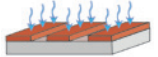
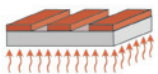
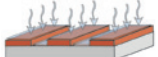
Process chemicals

Adhesion promoter	AR 300-80
Developer	AR 300-26, T: AR 300-44
Thinner	AR 300-12
Remover	AR 300-76, T: AR 300-76

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Process conditions

This diagram shows exemplary process steps for AR-P 3500 (T) 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 3510 4000 rpm, 60 s, 2.0 µm	AR-P 3540 T 4000 rpm, 60 s, 1.4 µm
Tempering (± 1 °C)		100 °C, 1 min, hot plate or 95 °C, 25 min, convection oven	
UV exposure		Broadband UV, 365 nm, 405 nm, 436 nm Exposure dose (E ₀ , broadband UV stepper): 55 mJ/cm ² 120 mJ/cm ²	
Development (21-23 °C ± 0,5 °C) puddle		AR 300-26, 1 : 5 60 s	AR 300-44 60 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 semiconductor properties or lift-off	
Removal		AR 300-70 or O ₂ plasma ashing	

Development recommendations

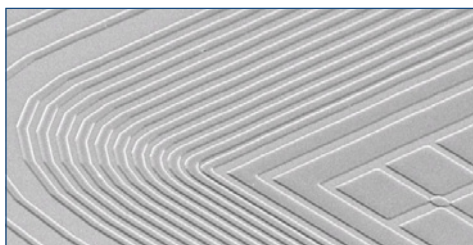
Resist / Developer	AR 300-26	AR 300-35	AR 300-40
AR-P 3510, 3540	1 : 5	1 : 1	300-47, 1 : 1
AR-P 3510 T, 3540 T	1 : 2	undil.	300-44

Focus width AR-P 3540 T g-line stepper

Ridge	DOF @ 230 mJ	Dose range
1.5 µm	> 2.0 µm	110-260 mJ/cm ²
1.0 µm	> 1.5 µm	130-260 mJ/cm ²
0.7 µm	> 1.25 µm	160-250 mJ/cm ²
0.5 µm	> 1.0 µm	190-240 mJ/cm ²

Best edge steepness: 180-200 mJ/cm²

Resist structures



AR-P 3500
Film thickness 2 µm
Resist structures 5 µm

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Focus width

Film thickness 1.5 μm on Si-wafer, dose: 230 mJ/cm^2

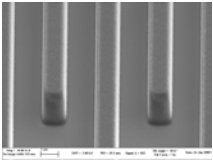
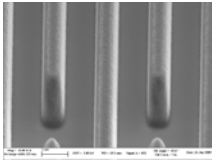
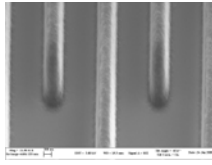
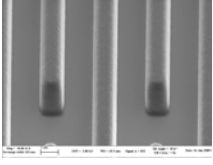
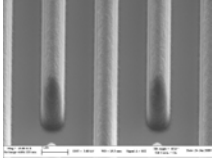
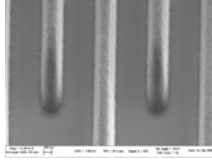
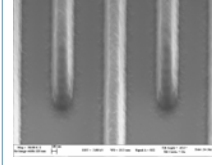
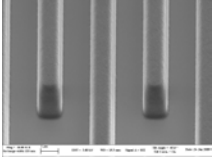
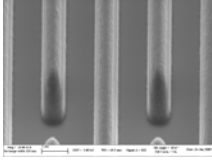
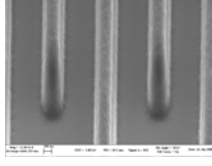
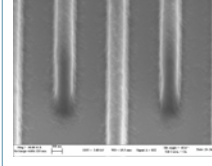
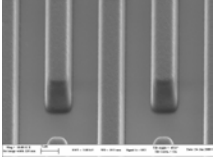
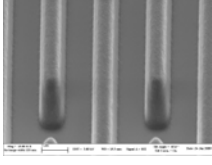
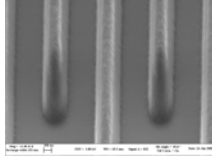
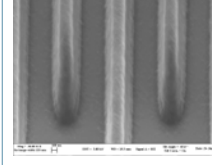
Focus	1.5 μm L/S	1.0 μm L/S	0.7 μm L/S	0.5 μm L/S
- 1.0				
- 0.75				
- 0.5				
- 0.25				
0.0				
+ 0.25				
+ 0.5				
+ 0.75				

Tempering: 95 $^{\circ}\text{C}$, 90 s, hot plate (contact), exposure: g-line stepper (NA: 0.56; 0.75 s).
Development: AR 300-44, 60 s, 22 $^{\circ}\text{C}$, puddle

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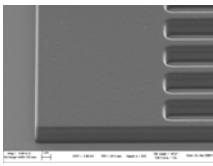
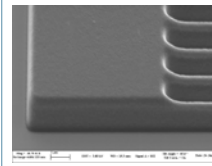
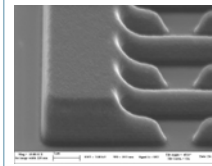
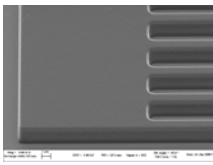
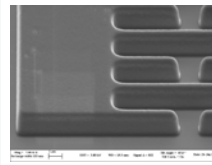
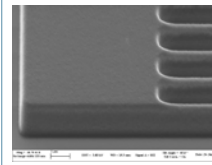
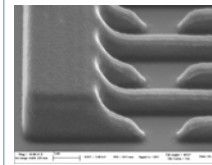
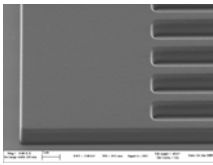
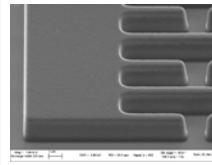
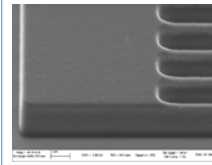
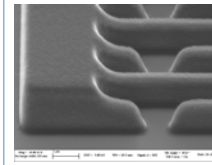
Linearity

Film thickness 1.5 μm on Si-wafer, focus: 0.0

Dose	1.5 μm L/S	1.0 μm L/S	0.7 μm L/S	0.5 μm L/S
160 mj				
190 mj				
210 mj				
230 mj				

Dark field erosion

Film thickness 1.5 μm on Si-wafer, focus: 0.0

Dose	1.5 μm L/S	1.0 μm L/S	0.7 μm L/S	0.5 μm L/S
190 mj				
210 mj				
230 mj				

Tempering: 95 °C, 90 s, hot plate (contact), exposure: g-line stepper (NA: 0.56; 0.75 s).
Development: AR 300-44, 60 s, 22 °C, puddle