



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

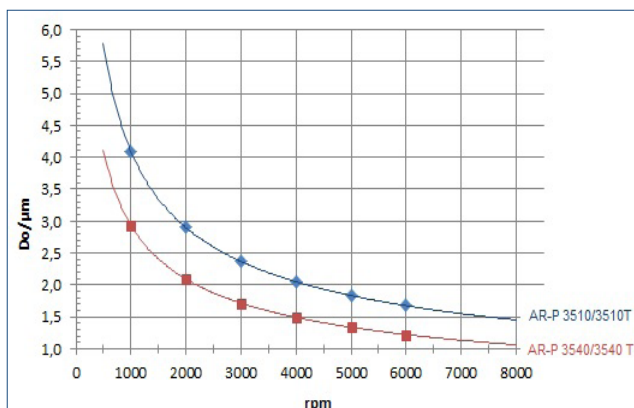
Characterisation

- 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

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 6 month (°C)	10 - 18	

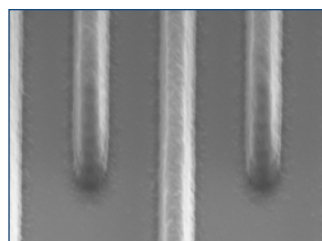
Spin curve



Properties II

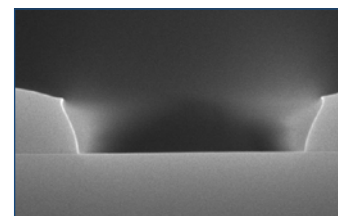
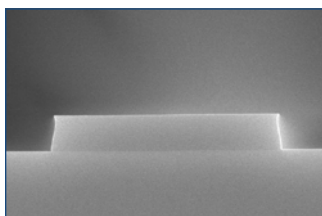
Glass transition temperature	108	
Dielectric constant	3.1	
Cauchy coefficients AR-P 3540 T	N ₀	1.627
	N ₁	71.4
	N ₂	164.8
Plasma etching rates (nm/min) (5 Pa, 240-250 V bias)	Ar-sputtering	7
	O ₂	165
	CF ₄	37
	80 CF ₄ + 16 O ₂	88

Structure resolution



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

Temperature stability



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

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

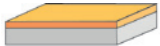
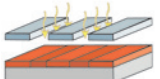
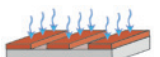
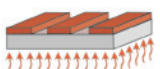
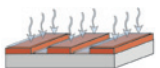
Process chemicals

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

Positive Photoresists AR-P 3500 / 3500 T

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

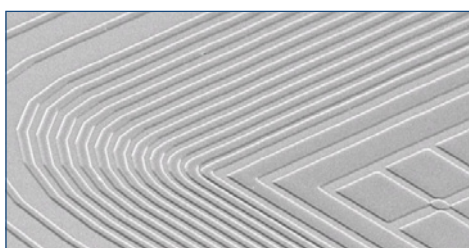
Resist / Developer	AR 300-26	AR 300-35	AR 300-40
AR-P 3510, 3540	1 : 5	1 : 1	300-47, 1 : 1
AR-P 3510 T, 3540 T	1 : 2	undil.	300-44

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

Positive Photoresists AR-P 3540 T

Focus width

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

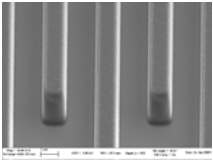
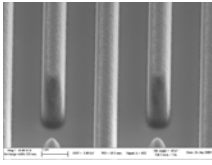
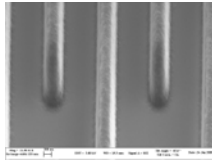
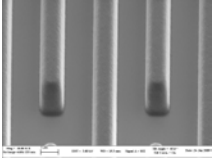
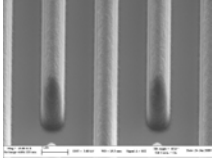
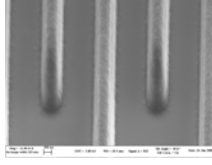
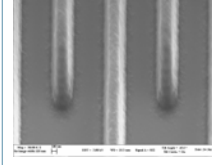
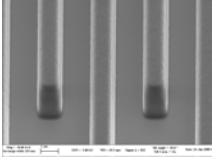
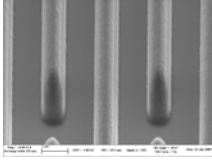
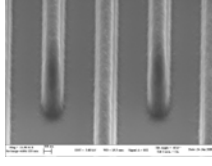
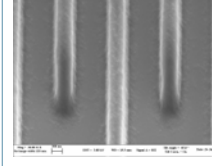
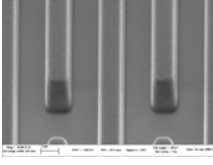
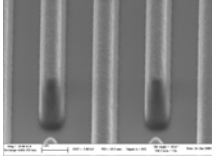
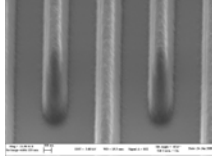
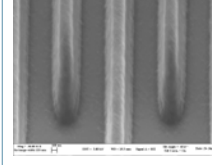
Focus	1.5 μm L/S	1.0 μm L/S	0.7 μm L/S	0.5 μm L/S
- 1.0				
- 0.75				
- 0.5				
- 0.25				
0.0				
+ 0.25				
+ 0.5				
+ 0.75				

Tempering: 95 °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

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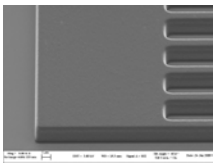
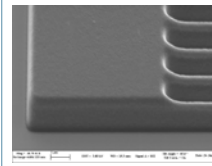
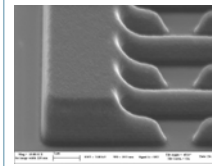
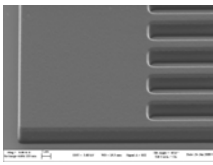
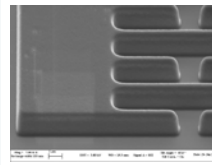
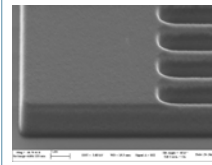
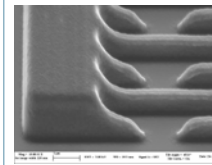
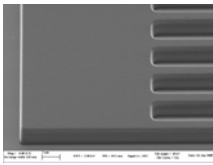
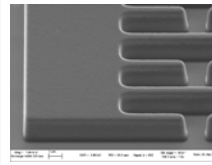
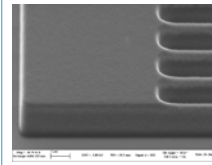
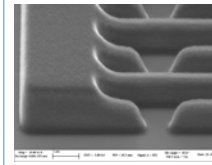
Linearity

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