



## Negative E-Beam Resists for mix & match

### AR-N 7500 (high resolution) and AR-N 7520 (highest resolution)

#### I. General Description

The **Negative E-Beam Resists AR-N 7500 and 7520** are **non-chemically amplified resists with a good sensitivity, very high resolution (< 30 nm) and an excellent process and plasma etching stability**. This resist is characterized by a high process stability which is due to the fact that the crosslinking is not based on the principle of chemical enhancement.

**A mix-&-match-process between e-beam and UV exposure (310 - 450 nm) is possible.** In UV-range 310 - 450 nm the resist **AR-N 7500** is working positive or negative, depending on the wavelength. While the resist **AR-N 7520** is only working negative in the range of 248 -270 nm and 310-365 nm.

Nanolithographic patterns of 20 - 80 nm within film thickness between 80 - 400 nm can be produced. The resists are characterized by a high contrast (>5). The pattern can be developed in an aqueous alkaline developer. Sensitivity lies between chemical amplified resists (AR-N 7700) and PMMA-resists. The plasma stability is about twice as high as the stability of PMMA resists.

The products are liquid resists containing novolak resins, naphthochinondiazides and crosslinking compounds in safer solvents propylene glycol methyl ether acetate.

#### 2. Parameters

Properties / Resist	AR-N	7500.18	7500.08	7520.18	7520.073
Solids content	%	18	8	18	7,3
<b>Film thickness at 4000 rpm</b> Semitec CPS 20, uncovered chuck, 2" Si-wafer	µm	<b>0.40</b>	<b>0.10</b>	<b>0.40</b>	<b>0.10</b>
Film thickness at 6000 - 1000 rpm	µm	0.3-0.8	0,1-0,2	0,3-0,8	0,1-0,2
Filtration	µm	0.2			
Flash point	°C	14-20			
Storage at temperatures	°C	10-18			
Guarantee from date of sale	months	6			

#### 3. Instructions for Processing

I.	• Coating
II.	• Soft bake: 85 + 1.0 °C, 30 min, convection oven or 85 + 1.0 °C, 1 min, hot plate
III.	• E-Beam exposure / UV-exposure
IV.	• Development: AR 300-47 diluted; recommended 4 parts of developer: 1 part of water



#### 4. Steps of Processing für AR-N 7500, 7520

(I.) Before handled the resist has to be adapted to the temperature of the working area (recommended is a range of 20 – 25 °C at a relative humidity of 30 to 50 %). The unexposed resist should be handled under yellow safe light.

The resist should be spin-coated at a speed ranging from 1000 to 8000 rpm.

(II.) Coated substrates should be prebaked on hot plate (85 + 1.0 °C for 1 minute) or in a convection oven at a temperature of 85 + 1.0 °C for 30 minutes.

(III.) These resists are suitable for application in e-beam or in UV-wavelength range of 310 - 450 nm. For a mix & match-process both steps of exposure (e-beam and UV-exposure) have to be carefully coordinated.

**AR-N 7500:** With e-beam radiation the resist works negative. The e-beam exposure has to be about 150  $\mu\text{C}/\text{cm}^2$  (20 kV, Do: 0,4  $\mu\text{m}$ ). The resist is working also negative with an UV exposure at 310 – 365 nm with following flood exposure at > 365 nm (optimal g-line). At a film thickness of 400 nm, the exposure dose is in a range of 100  $\text{mJ}/\text{cm}^2$  (i-line) for this resist. The sensitivity can be slightly increased by an additional bake step (85 °C, 2 min hot plate) after image-wise UV exposure. The AR-N 7500 is a positive working resist at exposure wavelength in range of 365 – 450 nm without following flood exposure.

**AR-N 7520:** With e-beam radiation the resist works negative. The e-beam exposure has to be about 200  $\mu\text{C}/\text{cm}^2$  (20 kV, Do: 0.4  $\mu\text{m}$ ). In deep UV (248-270 nm) or in mid UV (310-365 nm) the resist is only working negative. In this case is the processing easier in comparison with AR-N 7500. At a film thickness of 400 nm, the exposure dose is in a range of 100  $\text{mJ}/\text{cm}^2$  in deep-UV and approx. 75  $\text{mJ}/\text{cm}^2$  in mid UV for these resists. The sensitivity can be slightly increased by an additional bake step (85 °C, 2 min hot plate) after image-wise UV exposure.

(IV.) For development of the exposed resist layers **Developer AR 300-47** (metal ion free) is recommended. The developer should be diluted with deionized water (4:1). The time of development should be about 40 - 120 sec at 21-23 °C and the development of the unexposed parts should exceed at least 20 sec.

The developer can be adapted to contrast and speed in a wide range by varying the concentration. The dilution of the developer leads to an increase of contrast by decreasing speed.

Immediately after development resist layers have to be rinsed with deionized water.

A post development bake at about 130 °C leads to a good etching stability, owing to improved adhesion and resistance of the resist mask.

#### 5. Cleaning

Substrates and equipments can be cleaned with **Thinner AR 300-12** or **Remover AR 600-70**. Hard-baked layers can be stripped with **Remover AR 300-70**.

#### 6. Disposal and Safety References

Liquid or solid wastes have to be disposed at proper deposit places or by controlled combustion in officially authorized plants. Resists and thinner contain organic solvents. Adequate ventilation in the working area is demanded. Avoid direct contact with products and their vapours. Wear safety goggles and rubber gloves!

Please ask for safety data sheets!