Lithography

- Photoresist
- Mask or Reticle (step and repeat projection systems)
- Exposure System (contact aligner, stepper, e-beam and x-ray)
- Developer
Photoresist

Positive Resist

Resist Processes

Negative Resist

Better adhesion and used in plating and high temperature applications

High resolution capability exclusive choice for VLSI
Photoresist

- **Primary Functions** – precise pattern formation and protection of the substrate

- **Matrix Material** (resin) – serve as binder and establishes the mechanical properties of the film (adhesion, etch resistance, thermal flow stability, flexibility and thickness)

- **Sensitizer** – photoactive compound (reacts in response to the irradiation)

- **Solvent** – keep resist in the liquid state until it is applied to the substrate being processed.
Novolak and sensitizer bond through Hydrogen Bonding

- Sensitizer
- Novolak Resin

low molecule weight novolac

Sensitizer

(insoluble in aqueous developer)
Chemical Reactions of the sensitizer

Fig. 8 Sequence of photochemical transformations of the quinonediazide sensitizer (dissolution
Effect of Heat on Positive Photoresist

> 140 °C, resist will cross link and could not be lifted off anymore
Resist Processing : Soft-Bake

• Purposes Soft-Basek (Pre-bake):
  - Driving off the solvent; reducing its level in the film from 20-30% to 4-7%. The attack rate of the resist by the developer is significantly dependent on solvent concentration.
  - Improving the adhesion of the resist
  - Annealing the stresses caused by the shear forces encountered in the spinning process.

• Baking processes:
  Convection oven - 90 °C for 20 mins
  Infrared - reduce the baking times (3-4 mins). The IR penetrated the resist film and is reflected back by the resist substrate interface. (different substrate, lamp coating)
  Hot Plate - (30-60 Sec) Vacuum should be used to clamp the wafers.