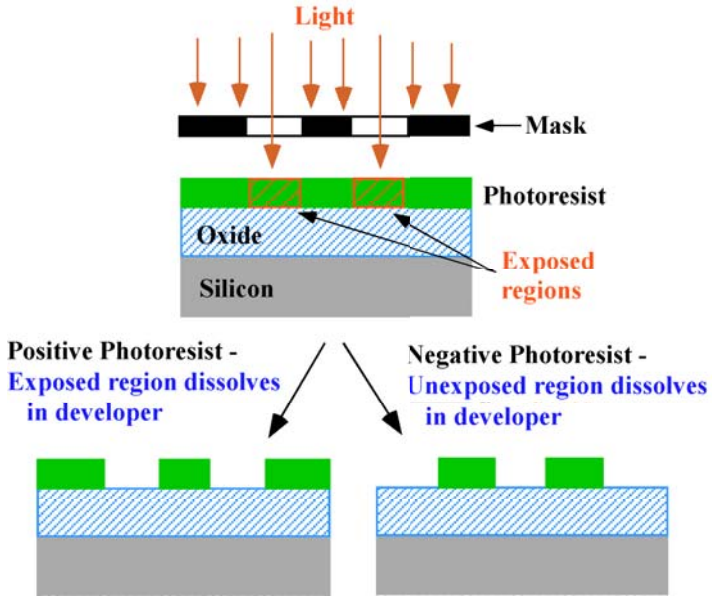
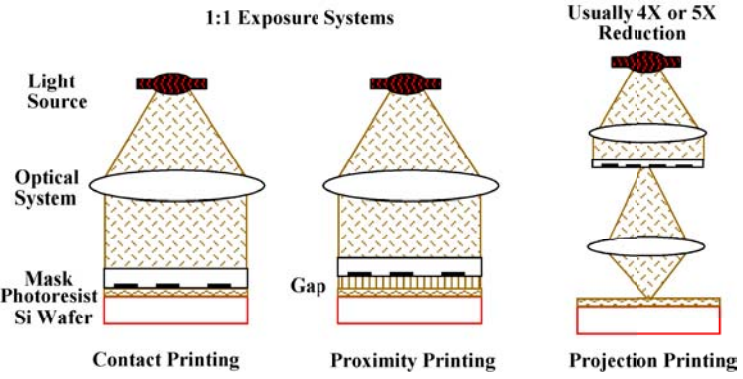
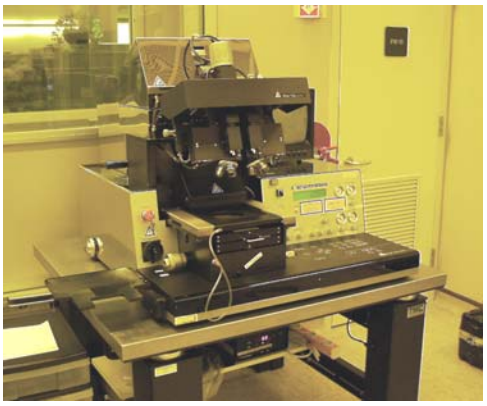
(4) Lithography



Drawing showing photolithography method to pattern photoresist on silicon surface



Diagrams of different type of optical lithography exposure systems



A lithography alignment and exposing tool in SNF

LIthography is the cornerstone of micro- and nanotechnology fabrication. It is the technique used in patterning the substrate and thin films into the micro- and nanometer-size structures. In optical or "photo" lithography, a film of light-sensitive organic photoresist is first deposited on the substrate surface. A glass plate that has a patterned chrome layer on it, called a mask, is held above the substrate. A source of ultra-violet (UV) light exposes only the areas of the UV light-sensitive photoresist layer that are not covered by chrome. Depending on the type of resist used, either the exposed or unexposed regions dissolve away in the developer solution. Therefore either a positive or negative image of the mask is transferred to the photoresist. That pattern is used to make patterns in the underlying films, as we will see in the Etching poster. The masks themselves are produced using similar methods, utlizing light, masks and photographic reduction, or using scanning laser or electron beams without masks, to produce very small patterns on the mask.

Several types of exposure systems are used. These include: **1. contact printers**, where the mask contacts the photoresist for good resolution but may damage the surface; **2. proximity printers**, where there is a gap to avoid the damage, but resolution is poor due to diffraction effects; and **3. projection printers**, where optics are used to project the image to give both very good resolution and no damage. The projection printers often only expose a small part of the wafer at a time and "step" across to expose the whole wafer - and hence are called "steppers." Often multiple levels of a structure require lithography steps, and the exposure systems must align the mask to lower levels on the wafer. **SNF has many lithography tools.** Yellow light is used in the lithography area to avoid unwanted exposure of the UV-sensitive photoresist.