(6) E-beam Lithography

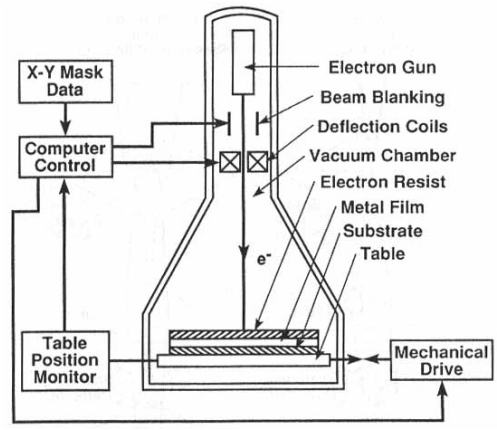
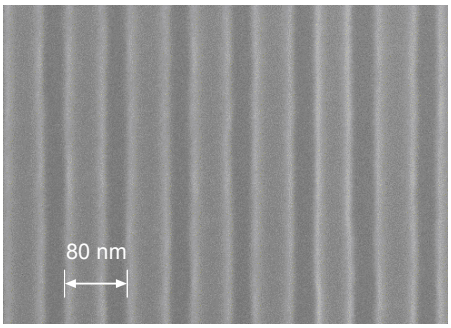


Diagram of electron beam lithgography system used to "direct-write" high resolution patterns



Scanning electron micrograph (SEM) of very narrow lines patterned by e-beam tool in SNF

An e-beam lithography tool in SNF

Electron beam lithography is used primarily for two purposes in our facility. One is for **very high resolution lithography.** The other is in **the fabrication of masks** for the optical lithography processes described earlier.

The smallest feature on a wafer that can be patterned using optical lithgraphy is dependant on the wavelength of light used and diffraction effects. **The practical limit for optical lithography is around 0.1 microns (100 nm). To define smaller features, electron beams, or "e-beams," (which have a wavelength on the order of 0.1 nm) can be used.** While e-beam projection systems using masks have not been fully developed yet for a variety of reasons, "direct-write" e-beam lithography has been used from many years. E-beams can be focused to very small dimensions, and then scanned or rastered over the wafer, thus exposing the photoresist one pixel at a time. A computer can control its path and when to turn it on and off. Direct-write e-beam lithography works as a series process, while optical lithgography works in parallel over the wafer. Because of this, the e-beam system is much slower. However, feature sizes smaller than 20 nm can be patterned. Two e-beam lithography systems are in this room: the Hitachi system for more mainstream jobs and the Raith system for more research applications.

E-beam systems can also produce the masks that are used in the optical lithography processes. Utilizing the direct-write technique, chrome films on quartz are patterned. Throughput is not as big an issue here since one mask can be used for countless optical lithography exposures.

Also in this room is a scanning electron microscope (SEM) which uses an e-beam to obtain highly magnified images of structures (see Measurements and Characterization poster).