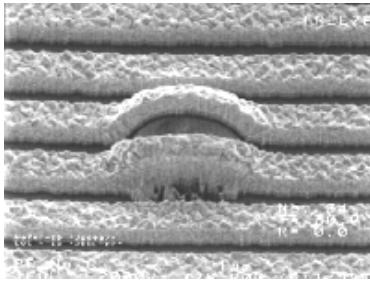
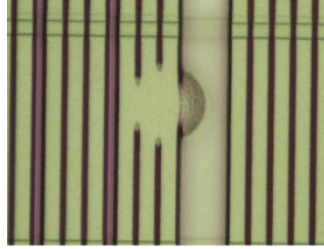
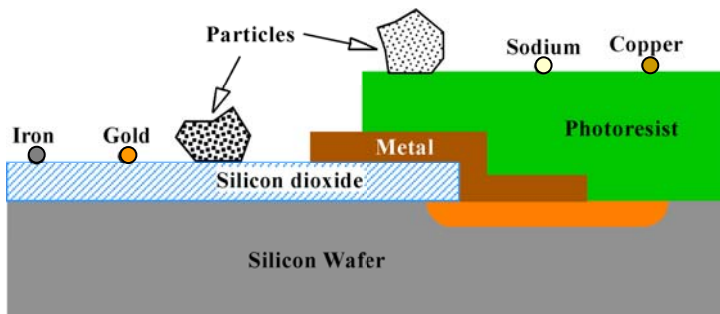


(1) Wafer Cleaning



Magnified images of contaminants on wafer surface which cause defects and failures in nanostructures



Example of a silicon wafer ready for cleaning



A “wet bench” in SNF where wafers are cleaned before processing steps

Because the micro- and nanostructures fabricated in this facility are so small (with feature sizes as small as 1/millionth of a centimeter) and sensitive to impurities, any small particle or very low levels of chemical contamination can cause a defect in the structure and render it useless. Particles can cause defects by blocking deposition or etching, or causing film adhesion problems. Impurity atoms and residual chemicals at even very low concentrations can chemically and electrically cause failures.

Contaminants include remnants of photoresist and chemicals used in processing, small concentrations of atoms or small clusters of metals, alkali ions (such as sodium from human skin, sweat, or even breath), and particles (usually 0.01 - 100 micrometers in size). Particles may originate from silicon and quartz dust, lint, and atmospheric dust. They can come from processing equipment and cleanroom personnel.

Even though the facility is kept very clean and very pure chemicals and liquids are used, the wafers still need to be cleaned, often between every processing step. Most cleans are based on immersion in liquid baths or sprays. Generally a sequence of different cleans is done. This may include sulfuric acid and hydrogen peroxide to remove photoresist and organics. A bath containing ammonium hydroxide and peroxide can be used to remove particles, organic contaminants and some metals. This is often followed by a bath of hydrochloric acid and peroxide to remove metal and ionic contaminants, and hydrofluoric acid can then remove any oxide that forms during the clean. Afterwards, wafers are spin-rinsed and dried in a tool resembling a clothes dryer.