

Semiconductor Technology from A to Z

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Fabrication Processes

How does Chemical-Mechanical Polishing (CMP) work?

CMP simultaneously attacks the wafer surface chemically with a reactive slurry and smooths it mechanically with a polishing pad. Raised features are removed faster than recessed areas, producing a globally planar surface. This is essential for multilevel interconnects, since each additional metal layer needs a flat base.

[Learn more in the Metallization section →](#)

How does lithography work in chip manufacturing?

A light-sensitive photoresist is applied to the wafer and exposed to UV light through a mask. Depending on the resist type, either the exposed or unexposed areas dissolve away during development, transferring the mask pattern into the resist. This pattern then serves as a template for subsequent etch or doping steps.

[Learn more in the chapter Exposure and Resist Coating →](#)

How does ion implantation work?

Dopant ions are accelerated in an electric field and shot into the wafer at high energy. Penetration depth depends on energy and ion mass, while the dose sets the dopant concentration. A subsequent anneal repairs crystal damage and electrically activates the dopant atoms.

[Learn more in the chapter Doping Techniques →](#)

How does Chemical Vapor Deposition (CVD) work?

Gaseous precursors are fed into a reaction chamber, where they react at or near the heated wafer surface to form a solid film. Depending on pressure and temperature, this yields APCVD, LPCVD, PECVD, or ALD processes. The technique produces highly uniform films that conformally coat even complex 3D structures.

[Learn more in the chapter Chemical Vapor Deposition →](#)

How does plasma etching work?

A process gas is converted by electrical energy into a plasma of ions, radicals,

and electrons. Reactive radicals chemically attack the material being etched, while accelerated ions remove it physically as well. This combination enables anisotropic etching with steep, precise edge profiles.

[Learn more in the chapter Dry Etch Processes →](#)

How does epitaxy work?

In epitaxy, a crystalline layer grows atomic layer by layer on a single-crystal substrate and adopts its crystal orientation. This typically happens from the gas phase (e.g., silicon vapor-phase epitaxy) under precise temperature and gas-flow control. The result is ultra-pure layers with exactly defined doping.

[Learn more in the chapter Chemical Vapor Deposition →](#)

How does a cleanroom work?

A cleanroom keeps airborne particle concentration extremely low through continuous filtration (HEPA/ULPA) and positive-pressure ventilation. Staff wear special clothing and follow strict procedures to avoid contamination. At nanometer-scale feature sizes, even a single dust particle can destroy an entire chip.

[Learn more in the Wet Chemistry section →](#)