

Scanning Capacitance Microscopy

Scanning capacitance microscopy (SCM) used a sharp conducting probe which is held above the surface of a sample and scanned across the sample. SCM characterizes the surface of the sample using information obtained from the change in electrostatic capacitance between the surface and the probe.

More precisely SCM uses an ultra-sharp conducting probe (often Pt/Ir or Co/Cr metal covering an etched silicon probe) to form a metal-insulator-semiconductor (MIS/MOS) capacitor with a semiconductor sample if a native oxide is present. When no oxide is present, a shottky capacitor is formed. When the probe and surface are in contact, an AC bias is applied, generating capacitance variations in the sample which can be detected using a GHz resonant capacitance sensor. The tip is then scanned across the semiconductor's surface in 2D while the tip's height is controlled by conventional contact force feedback .

By applying an alternating bias to the metal-coated probe, carriers alternately accumulate and deplete within the semiconductor's surface layers, changing the tip-sample capacitance. The magnitude of this change in capacitance with the applied voltage gives information about the concentration of carriers (SCM amplitude data), whereas the difference in phase between the capacitance change and the applied, alternating bias carries information about the sign of the charge carriers (SCM phase data). Due to the fact that SCM functions even through an insulating layer, a finite conductivity is not required to measure the electrical properties.