

Combined ultrahigh vacuum scanning tunneling microscope scanning electron microscope system

U. Memmert, U. Hodel, and U. Hartmann

We describe a combined ultrahigh vacuum scanning tunneling microscope (STM)–scanning electron microscope (SEM) system, which allows to position the STM tip with respect to the sample within an area of 5 mm×5 mm under SEM control. While the SEM resolution is sufficient to clearly resolve sub- μm structures on the samples, the STM features atomic resolution on semiconductor surfaces. The combination of SEM and STM allows high-resolution studies on inhomogeneous samples in materials research as well as the use for micro- and nanoelectronic device characterization or device modification. The STM performance was checked by atomically resolved imaging of Si(111) (7×7) surfaces. The STM/SEM combination and its application in device characterization is demonstrated by the investigation of vertically grown resonant tunneling diodes on an AlAs/GaAs basis. Due to its performance the system has a high potential for high-resolution imaging in materials research, for novel device characterization and nanoscale structuring or modification of very small devices.