Surface Studies Using the Variable Temperature Scanning Probe Microscopy (SPM)

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With the birth of the scanning tunneling microscope (STM), surface image observations on the atomic and molecular levels and evaluation of the properties of materials have become possible. Recently, noncontact imaging has been also developed for atomic force microscopy (AFM) in ultrahigh vacuum in order to avoid the damage to the sample surface due to interaction between the clean surfaces of the sample and cantilever.

An outline of an ultrahigh-vacuum scanning tunneling microscope (UHV-STM) and an atomic force microscope (UHV-AFM) which allow atomic-level observation under varying temperature will be reported. Also, its high-temperature (HT) and low-temperature (LT) applications of semiconductor surfaces concerning various surface changes on the Si(111), Si(110) and Si(100) surfaces to the new reconstructed structures at high temperatures, various surface behaviors, ultra-micro processing, adsorption of different atom species and growth process, and low-temperature buckling structures of Si(100) dimer rows during ultralow temperature observation will be reported.