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Surface-state Emission of Si(111)-(7x7) Induced by Scanning Tunneling Microscopy[1] HIROSHI IMADA, MASASHI OHTA, NAOKI YAMAMOTO, Condensed Matter Physics, Tokyo Institute of Technology — The luminescence measurement method we employ which utilizes a phenomenon called scanning tunneling microscope light emission (STM-LE) enables us to investigate surface structures with atomic resolution. However, STM-LE has not been well established, because the involved physics leaves many problems to be solved. In the present work, we studied STM-LE from Si(111)-7x7 surface to elucidate the nature of STM-LE of semiconductor surfac. All the experiments were performed in an UHV-STM. Ag-covered Mo tips were used. Photon mapping and spectral measurement were performed. Emission spectra of Si(111)-7x7 at both bias polarities show very similar shape and behavior. The peaks are at 1.4eV, 2.3eV and around 1.8eV and do not shift with applied voltage. Since the position of the peak around 1.8eV shifts with tip shape but those of the 1.4eV and 2.3eV do not, the 1.4eV and 2.3eV peaks are intrinsic to Si(111)-7x7 surface. Whole emission mechanism includes excitation of localized surface plasmon (LSP), excitation and decay (light emission) of surface electron and enhancement of the light. The photon maps show so high spatial resolution that individual adatoms can be clearly recognized.

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