Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Local electronic structure of a quantum point contact observed with STM KATSUMI NAGAOKA, SNIN YAGINUMA, TADAAKI NAGAO, TOMONOBU NAKAYAMA, National Institute for Materials Science — A quantum point contact (QPC) is realized when a width of an electron conduction channel is comparable to the Fermi wavelength of electrons in a material. Since the first observation that QPCs show the conductance quantization in units of $G_0=2e^2/h$, QPCs have been mainly used in transport measurements. But the quantized states of confined electrons, which are the origin of the quantized conductance in the transport measurements, have not been observed directly so far. We report the direct observation of electronic structures of QPCs using an STM spectroscopy at 77K. The QPCs are formed across boundary gaps between a multi-domain Bi film on a Si(111)-$\beta\sqrt{3}$x$\sqrt{3}$-Bi substrate. Since the QPCs are formed in the direction parallel to the substrate, the direct observations of the atomic and the local electronic structures by using STM are possible. The electronic structure of the QPCs is neither sensitive to the external electric field induced by the STM tip nor to the length of the bridging part, and is well-explained by electronic confinement in a one-dimensional cylindrical potential well.

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Date submitted: 24 Nov 2005 Electronic form version 1.4