NANOSTRUCTURE FABRICATION FOR MESOSCOPIC DEVICES

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Nanostructure fabrication technology is one of the key technology for both basic and applied research for mesoscopic phenomena. For fabrication of mesoscopic structure, pattern delineation techniques with a dimension smaller than various characteristic length of an electron, and noble processing techniques which induce no significant damage and surface contamination are required. Thus, various techniques using electron, ion, and photon beams have been investigated.

Some of primitive concepts for future electron devices have been proposed in recent years. In a single mode wire or a quantum box array, the extremely high mobility is expected to be realized due to the suppression of impurity and phonon scattering. In the samples smaller than the phase coherent length, the quantum interference plays an essential role. In the samples smaller than the elastic mean free path electron transport becomes ballistic. The quantum channel smaller than or comparable with such characteristic lengths behaves as an electron waveguide.

In this report, nanofabrication techniques for mesoscopic devices are discussed with putting emphasis on the effect of damage and sidewall roughness. It is shown that performance of mesoscopic devices should be sensitive to damage and sidewall roughness. It is also shown that low energy focused ion beam is promising as a nanofabrication technique to minimize damage.