N1-009

Dynamics of Nanopore on the Apex of the Pyramid

Seong Soo Choi[1], Tokuro Yamaguchi[2], Myoung Jin Park[1], Sung In Kim[3], Kyung Jin Kim[3], Kun Ho Kim[4]

[1]Research Center for Nanoscience, SunMoon Unviersity, Asan 336-708, [2]University Instrument Center, SunMoon University, [3]Team for Measurement and Analysis, National Nanofabrication Center, Daejeon, [4]Department of Physics, Gyeongsang University, Jinju, Korea

In this report, the plasmonic nanopores of less than 5 nm diameter were fabricated on the apex of the pyramidal cavity array. The metallic pyramidal pit cavity can also utilized as the plasmonic bioreactor, and the fabricated Au or Al metallic nanopore can provide the controllable translocation speed down using the plasmonic optical force.

Initially, the SiO2 nanopore on the pyramidal pit cavity were fabricated using conventional microfabrication techniques. Then, the metallic thin film was sputter-deposited, followed by surface modification of the nanometer thick membrane using FESEM, TEM and EPMA. The huge electron intensity of FESEM with ~microsecond scan speed can provide the rapid solid phase surface transformation. However, the moderate electron beam intensity from the normal TEM without high speed scanning can only provide the liquid phase surface modification.

After metal deposition, the 100 nm diameter aperture using FIB beam drilling was obtained in order to obtain the uniform nano-aperture. Then, the nanometer size aperture was reduced down to ~50 nm using electron beam surface modification using high speed scanning FESEM. The followed EPMA electron beam exposure without high speed scanning presents the reduction of the nanosize aperture down to 10 nm. During these processes, the widening or the shrinking of the nanometer pore was observed depending upon the electron beam intensity. Finally, using 200 keV TEM, the diameter of the nanopore was successively down from 10 nm down to 1.5 nm.

Keywords: nanopore, electron beam, field emission scanning electron microscopy, sp;id phase, liquid phase