HIGH ASPECT AND SPACE RATIO SUB-MICRO STRUCTURE FABRICTATION WITH MEV PROTON BEAM

V. Auzelyte, M. Elfman, P. Kristiansson, F. Andersson, J. Pallon, M. Wegdén, C. Nilsson, and N. Arteaga

Department of Nuclear Physics, Lund Institute of Technology, Lund, Sweden

A MeV proton beam witting set-up has been implemented and tested at new Lund Nuclear sub-micron beamline. The beam of 1-0.5 μm size is focused using four Oxford quadrupoles separated in doublets driven by high stability power supplies. The fast beam scanning coils placed in a vacuum chamber writes a pattern of maximum 4096×4096 pixels with a speed of 10 kHz. The samples are placed in a focusing plane 7 cm after the last set of magnets on a sample holder driven by a high precision stepping motor controlled by a computer. The patterns consisting of single pixel lines and dots were irradiated to define the smallest free-standing structure.

2.5 MeV proton beam was used to pattern a lithographic resist and silicon that was after electrochemically etched to reveal structures. The free-standing posts of the size of the beam and aspect ration > 20:1 has been fabricated. Due the absence of a proximity effect the special density, a structure- gap size, of 2:1 have been archived. The choice material with good rigidity and adhesion is shown to be of great importance for high aspect and space ratio fabrication, because free-standing structures tend to bend or collapse. Additionally, we present two applications in that are being developed within the project.