

# Planar magnetic junction devices fabricated by atomic force microscope lithography

D. S. Yu, S. K. Jerng, S. H. Chun\*

Department of Physics and Institute of Fundamental Physics, Sejong University, Seoul 143-747, Korea

Magnetic tunnel junctions have been of great interest to magnetism and materials societies because of their potential application to next generation memory devices. Typically the junctions are fabricated by patterning a vertical stack of layers consisting of ferromagnetic materials and insulators. In some applications, however, planar-type junctions are desirable because of the geometrical simplicity. Selective oxidation of ferromagnetic metals by an atomic force microscope (AFM) offers a simple way to make planar-type magnetic junctions. Here, we demonstrate that lateral Ni/Ni oxide/Ni junctions can be fabricated by AFM lithography. Micro-patterns of 10-nm thick Ni films were defined by photolithography and lift-off. Ni oxide wires, then, were formed by scanning the AFM tip across a 10- $\mu$ m bridge while applying a bias voltage up to 10 V between the tip and the sample. The surface topography measured by AFM revealed the formation of Ni oxide wires. The junction containing one Ni oxide wire showed a non-linear current-voltage characteristics at room temperature. The junction resistance increased drastically on cooling, implying the tunneling nature of charge transport. Temperature and magnetic field dependences of transport properties will be discussed also.

This work was supported by the Korea Institute of Science and Technology (KIST) Vision 21 program.