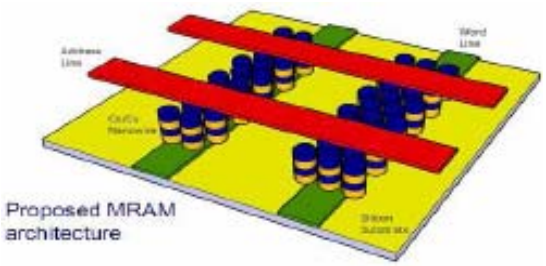
Self-Assembled Nanowires on Si for MRAM and Microwave Oscillator Arrays

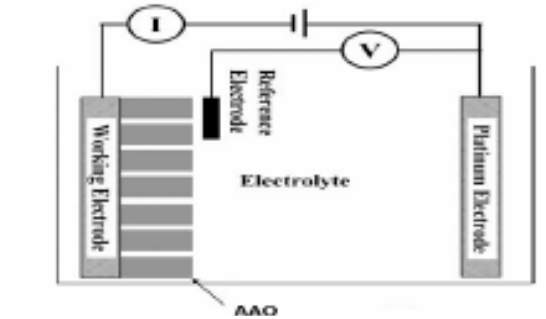
Bethanie J.H. Stadler (PI) and Mazin M. Maqableh

Electrical & Computer Engineering, University of Minnesota

NNIN Facility utilized: Characterization Facility & Nanofabrication Center

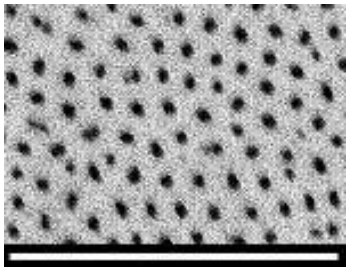
Motivation: Anodic Aluminum Oxide (AAO) is a promising template material for fabricating nanowires. Growing it directly onto silicon improves its structural integrity and opens the prospect of various silicon compatible fabrication techniques. Devices, such as MRAM, and catalysts stand to benefit from the combination of silicon processing and the self assembly properties of AAO.





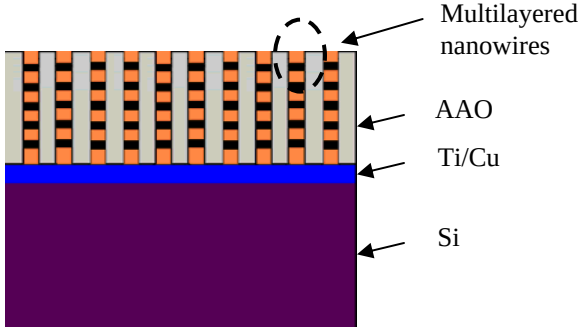
Schematic of DC Electrodeposition

Fabrication: Anodic Aluminum Oxide (AAO) can be controllably grown on Si by electrochemically anodizing an aluminum thin film initially grown on Si. The barrier layer which is a thin layer of aluminum oxide existing at the bottom of the nanopores can be completely removed.



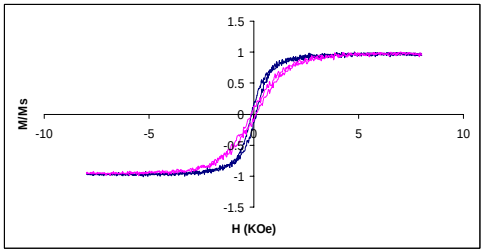
Nanopores on Silicon substrate (scale bar = 1µm)

Nanowires can be electrochemically deposited into the pores opening the way to the fabrication of future nanosensors, MRAM and microwave oscillator arrays.

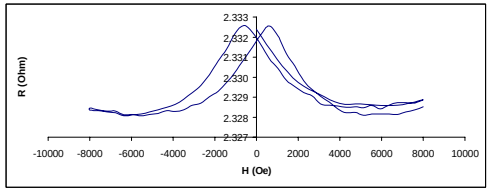


Structure of nanowires integration

Multilayered magnetic nanowires, due to their giant magnetoresistance (GMR), are good candidates for future nanosensors and microwave oscillator arrays in which milliwatt power levels can be emitted opening the chance for many applications in microwave and wireless communications.



MH loop of Co(7.5nm)/Cu(5nm) multilayered (64 layers) nanowires with nanowires perpendicular (blue) and parallel (pink) to the field



GMR of Co(7.5nm)/Cu(5nm) multilayered nanowires (50 layers)