Fabrication of Nanostructures for Magnonic and Spintronic Applications

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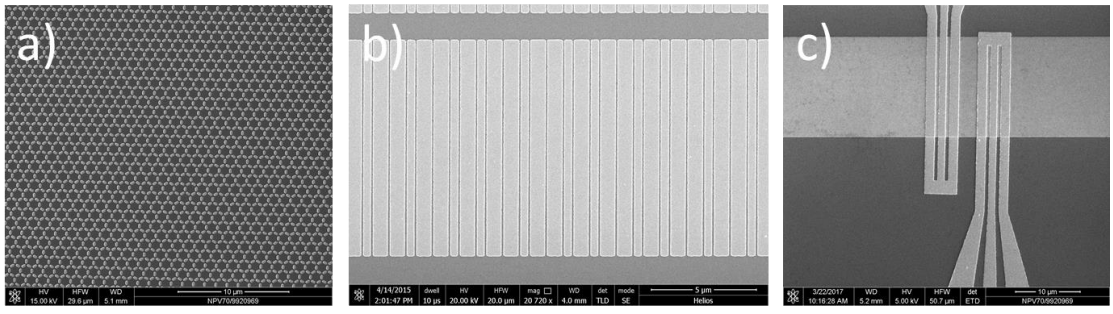
Magnonics and spintronics are now highly developed areas in physics that open possibilities to fabricate new magnetic devices allowing for operation with spin/magnon in nanoscale. This approach is highly important for a new type of ultra-fast magnetic memories [1] and for new concepts in information technology [2]. An important aspect of this research and consequent future applications is a fabrication of magnetic active elements, which have to be combined with the architecture of whole device integrated with conventional electronic elements. In many cases, it is required that the individual elements of a structure have to be made in the submicron scale, which means that patterning of thin films with thicknesses in the nanometer range need to be performed using the electron beam lithography (EBL) or the focused ion beam (FIB). Combining these methods with maskless photolithography (MPL), which can be done in the areas of 6-inch wafers, open the way to fabricate complete devices for magnonic and spintronic applications.

In this talk, the technology of manufacturing of magnetic structures in the submicron scale will be presented using the infrastructure of the Wielkopolska Center for Advanced Technologies and the Institute of Molecular Physics, Polish Academy of Sciences. I will focus on technological aspects of nano- and microstructure patterning using EBL, FIB, and MPL techniques. Based on the fabrication of the $Ni_{80}Fe_{20}$ kagome lattice and the one-dimensional magnonic crystals in the form of periodic and quasiperiodic $Ni_{80}Fe_{20}$ stripes using EBL and lift-off technique the preparation difficulties will be discussed. Additionally, propagation of the spin waves in CoFeB/NiO system and Yttrium Iron Garnet thin film will be shown using Vector Network Analyzer and two coplanar waveguides (CPWs) made by MPL.



Scanning electron microscopy images of: a) $Ni_{80}Fe_{20}$ kagome lattice, b) quasiperiodic $Ni_{80}Fe_{20}$ stripes and c) CoFeB/NiO microstripe with deposited CPWs

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