ENHANCEMENT OF MAGNETIC DOMAIN WALL VELOCITY BY OSCILLATING MAGNETIC FIELDS

K. Weerts[1,2], W. Van Roy[1], G. Borghs[1], L. Lagae[1]
[1]*Imec, Kapeldreef 75, 3001 Leuven, Belgium*
[2]*ESAT, KULeuven*

Dynamics of domain walls (DWs) subject to magnetic field and current pulses have recently attracted much attention [1,2,3]. Domain wall movements can be used to change the magnetization state of a magnetic element, or to propagate information. Here we present results of time resolved MOKE measurements on field-induced domain wall propagation in $Ni_{80}Fe_{20}$ nanowires. We show that an oscillating magnetic field superimposed on a magnetic field pulse can enhance the DW velocity at a specific resonance frequency. Domain wall propagation is initiated by a magnetic field pulse and probed by a laser pulse, synchronized and delayed with respect to the field pulse. The setup has a spatial resolution of 700nm and a time resolution of 50ps (Figure 1(a)).

All measurements are performed on a 12µm x 750nm or 12µm x 1µm wire, with a 4µm x 3µm nucleation pad on one side, and a tapered end at the other. The nanowires are patterned with ebeam-lithography in 12nm thick $Ni_{80}Fe_{20}$ (Figure 1(b)). A DC magnetic field is applied in –x direction, together with a pulsed magnetic field along +x. The pulsed field is used to initiate the DW propagation, while the DC field resets the device through DW propagation after the end of the pulse. An oscillating magnetic field is superimposed on these fields, with a frequency ranging from 0 to 500 MHz. Figure 1(c) shows the measured DW velocity as a function of the frequency of the AC field. It can clearly be seen that the DW velocity is enhanced at a resonant frequency, which is dependent on wire width and the applied DC field. OOMMF-simulations are being performed in order to clarify the enhanced DW propagation. Future work is focussed on a better understanding of these phenomena, as well as a detailed study of the depinning of a DW at a notch, under influence of an oscillating magnetic field.

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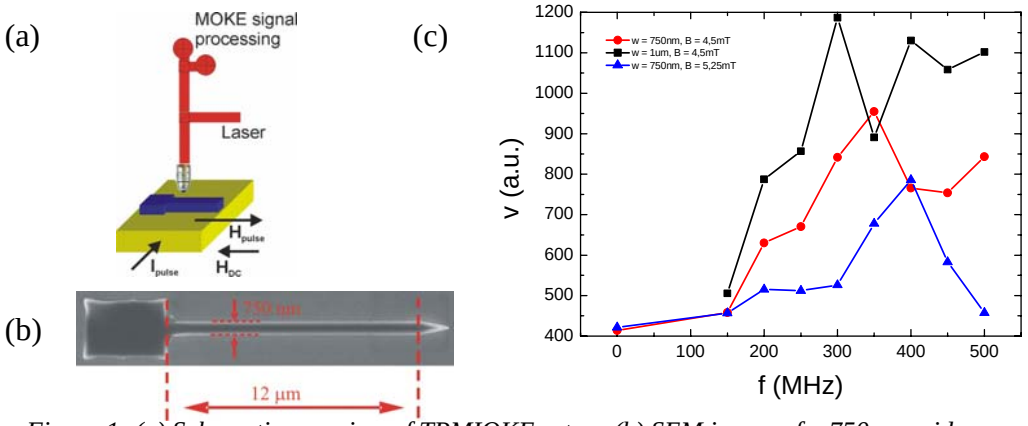

Figure 1: (a) Schematic overview of TRMIOKE setup; (b) SEM image of a 750 nm wide nanowire; (c) Enhanced DW velocity as a function of frequency of applied magnetic field.