T05

Selective Chirality Switching for the Field-driven Domain Wall Moition

Soo-Man Seo*, Soon-Wook Jung[1], Hyun-Woo Lee[1] and Kyung-Jin Lee
Department of Materials Science and Engineering, Korea University
[1]PCTP and Department of Physics, Pohang University of Science and Technology

The domain wall (DW) dynamics in a magnetic nanowire has received considerable interest because of its potential for applications in logic and storage devices [1]. It is essential to understand and to control the changes of internal spin structure in a moving DW driven by an external magnetic field. One of the characteristics of DW is the chirality defined by the sense of rotation of internal spin configuration, so-called clockwise DW (c=+1) and counter-clockwise DW (c=-1). This DW chirality can be used as information unit by which its stray field can be detected by a magnetic field sensor.

The DW chirality keeps its initial state for the field below the Walker field whereas it oscillates between c=+1 and c=-1 above walker field. Because of this difficulty, an artificial structural defect such as across-shaped trap has been proposed as a chirality-filter [2].

In the present study, we use the analytical model and micromagnetics to demonstrate an alternative approach for controllable chirality switching of a moving DW using an in-plane oblique field. The chirality of DW is selectively determined according to the oblique angle of the applying field, since the Walker breakdown occurs two times when an oblique field with a proper sign and magnitude is applied (Fig. 1). The difference between the two Walker fields becomes larger as either the oblique angle or the damping constant increases. Thus it is possible to obtain a reasonable wide window of the oblique field strength for the selective chirality switching.

[1] D. A. Allwood et al., Science **296**, 2003 (2002); S. S. P. Parkin et al., Science **320**, 190 (2008).
[2] E. R. Lewis et al., Phys. Rev. Lett., **102**, 057209 (2009).

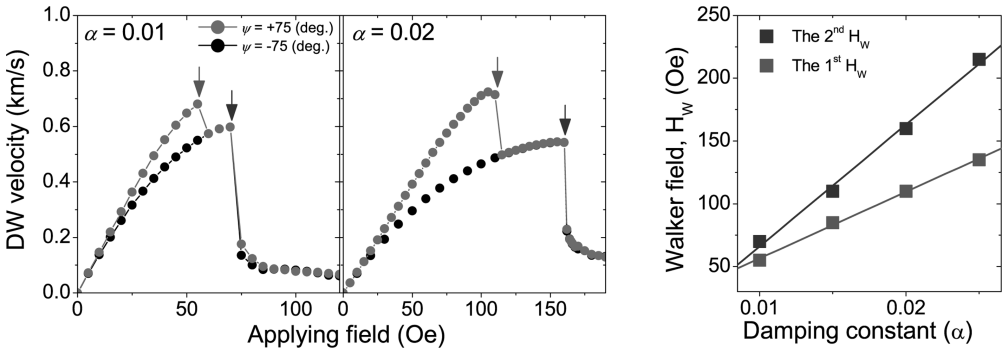

Fig. 1. (Left) Domain wall velocity as a function of an applying field. (Right) Walker field as a function of the Gilbert damping constant.