Erratum: Fast Domain Wall Motion Governed by Topology and Œrsted Fields in Cylindrical Magnetic Nanowires [Phys. Rev. Lett. 123, 217201 (2019)]

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In the Letter and Supplemental Material we used values for the spontaneous magnetization $M_s = 0.67$ MA/m and exchange stiffness $A = 1.1 \times 10^{-11}$ J/m for both numerical and analytical micromagnetic modeling. We stated that these are suitable for nanowires with composition $Co_{30}Ni_{70}$; however, the given values correspond instead to a composition of $Co_{20}Ni_{80}$.

Thus, the simulated critical current density, $j_c = 1.5 \times 10^{12}$ A/m^2, required for the switching of circulation of the Bloch-point domain wall in a 90 nm diameter nanowire, cannot be directly compared to the experimental value $j_c = 1.4 \times 10^{12}$ A/m^2 for the same wire diameter but composition $Co_{30}Ni_{70}$. For this composition, one should use $M_s = 0.77$ MA/m [1] and $A = 1.5 \times 10^{-11}$ J/m [2] instead (room temperature values). These values were calculated based on the fact that M_s and A are expected to vary nearly linearly with respect to their composition at dominant Ni content. M_s was also determined experimentally through room temperature magnetometry measurements performed on our nanowire samples still within the alumina template, with corrections made for demagnetization that comes with uncertainties on wire diameter, template porosity, and curve fitting [3]. This gives $M_s = 0.86 \pm 0.14$ MA/m, which considering the error range is in reasonable agreement with the theoretical calculation.

We can employ the usual micromagnetic scaling procedure for soft magnetic materials to translate the results mentioned in the Letter for $Co_{20}Ni_{80}$ to those for $Co_{30}Ni_{70}$. Magnetic fields are normalized to magnetization and lengths to the dipolar exchange length, $\Delta_d = \sqrt{2A/(\mu_0 M_s^2)}$ (6.25 nm for $Co_{20}Ni_{80}$ and 6.34 nm for $Co_{30}Ni_{70}$), which translates the density of current normalized by M_s/Δ_d as the source of the Œrsted field.

The scaling leads to $j_c \approx 1.7 \times 10^{12}$ A/m^2, however, valid for a diameter scaled to 91.4, instead of 90 nm in the simulation. We now need to consider the expected scaling of critical current with $1/R^3$, mentioned in the Letter, to finally translate to a nanowire with composition $Co_{30}Ni_{70}$ and diameter 90 nm, giving $j_c \approx 1.8 \times 10^{12}$ A/m^2. In the end, the agreement of the switching current between experiments and simulations remains reasonable, especially considering the uncertainty on the exact value of A for these CoNi alloys and the temperature dependence of both A and M_s.

Note also that the amplitude of the effect of spin-polarized current u, defined on p. 3, is instead 52.6 m/s per 10^{12} A/m^2 for composition $Co_{30}Ni_{70}$. This does not affect the conclusion that the domain wall speed $v \gg u$, and thus of the absence of Walker breakdown in nanowires.

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