

# **Domain wall propagation tuning in magnetic nanowires through geometric modulation**

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## **Abstract**

The magnetic behavior of nickel modulated nanowires embedded in porous alumina membranes is investigated. Their diameters exhibit a sharp transition between below (35 nm) and above (52 nm) the theoretical limit for transverse and vortex domain walls. Magnetic hysteresis loops and first-order reversal curves (FORCs) were measured on several ordered nanowire arrays with different wide-narrow segment lengths ratio and compared with those from homogenous nanowires. The experimental magnetic response evidences a rather complex susceptibility behavior for nanowires with modulated diameter. Micromagnetic simulations on isolated and first-neighbors arrays of nanowires show that the domain wall structure, which depends on the segment diameter, suffers a transformation while crossing the diameter modulation, but without any pinning. The experimental array magnetic behavior can be ascribed to a heterogeneous stray field induced by the diameter modulation, yielding a stronger interaction field at the wide extremity than at the narrow one. The results evidence the possibility to control the domain wall propagation and morphology by modulating the lateral aspect of the magnetic entity.

## **keywords**

Alumina, Magnetic hysteresis, Magnetic materials, Magnetism, Modulation. Nanowires.