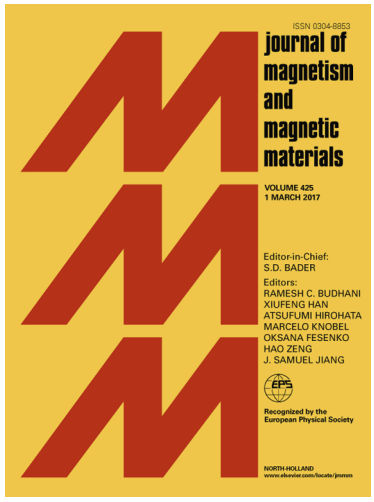

Characterization and modeling of magnetic domain wall dynamics using reconstituted hysteresis loops from Barkhausen noise

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Characterization and modeling of magnetic domain wall dynamics using reconstituted hysteresis loops from Barkhausen noise.

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ABSTRACT

By means of a post-processing technique, we succeeded in plotting magnetic Barkhausen noise energy hysteresis cycles $MBN_{energy}(H)$. These cycles were compared to the usual hysteresis cycles, displaying the evolution of the magnetic induction field B versus the magnetic excitation H. The divergence between these comparisons as the excitation frequency was increased gave rise to the conclusion that there was a difference in the dynamics of the induction field and of the MBN_{energy} related to the domain wall movements. Indeed, for the MBN_{energy} hysteresis cycle, merely the domain wall movements were involved. On the other hand, for the usual $B(H)$ cycle, two dynamic contributions were observed: domain wall movements and diffusion of the magnetic field excitation. From a simulation point of view, it was demonstrated that over a large frequency bandwidth a correct dynamic behavior of the domain wall movement $MBN_{energy}(H)$ cycle could be taken into account using first-order derivation whereas fractional orders were required for the $B(H)$ cycles. The present article also gives a detailed description of how to use the developed