EFFECT OF THERMAL FLUCTUATIONS ON FIRST-ORDER REVERSAL CURVES OF SINGLE-DOMAIN PARTICLES

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If thermal fluctuations are ignored, the theory for isolated single-domain particles predicts a very simple hysteresis loop involving jumps between two stable magnetization curves. The associated first-order reversal curve (FORC) function for randomly oriented single-domain particles has some distinctive features that are observed in real samples: a negative region near the H_u axis and a sharp ridge (theoretically infinite) on the H_c axis. However, in real samples there is generally a symmetric spreading about the H_c axis that is not predicted by the theory. This could be due to particle interactions or thermal fluctuations.

A new theory is developed for the effect of thermal interactions in systems of randomly oriented single-domain particles. As the field approaches the critical field for instability, the probability of a jump increases because the energy barrier between states is decreasing. The main hysteresis loop shrinks and the simple two-curve hysteresis of a given particle is replaced by an area in which a first-order reversal curve passes through every point. All jumps are replaced by continuous transitions, the ridge becomes finite, and the symmetry of the FORC function is broken.

Hysteresis, FORC, single-domain, relaxation

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