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A first principle study of viscous magnetization processes in pseudo-single domain particles and their possible influence upon natural remanence in rocks

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We present the first quantitative calculation of viscous remanence acquisition and decay in pseudo-single domain magnetite particles. The calculation is based on a statistical evaluation of exactly determined energy barriers between local energy minima. This is achieved by developing a fast relaxation algorithm for finding the optimal transition paths between these local energy minima in a three-dimensional micromagnetic model. The algorithm combines a nudged elastic band technique with action minimization. For a cubic pseudo-single domain particle, 60 different local energy minima are identified and all optimal transition paths between them are numerically calculated. From the transition paths it is possible to obtain the transition probabilities in weak external fields and to set up a linear matrix equation for viscous decay and remanence acquisition. We find a new interesting mechanism of intermediate remanence overshooting during VRM acquisition, and can explain for extremely stable VRM in pseudo-single domain particles.