Direct observation of the thermal demagnetization of magnetic vortex structures in nonideal magnetite recorders

Direct observation of the thermal demagnetization of magnetic vortex structures in nonideal magnetite recorders: Thermal Demagnetization of Vortex States

The thermal demagnetization of pseudo-single-domain (PSD) magnetite (Fe₃O₄) particles, which govern the magnetic signal in many igneous rocks, is examined using off-axis electron holography. Visualization of a vortex structure held by an individual Fe₃O₄ particle (~250nm in diameter) during in situ heating is achieved through the construction and examination of magnetic-induction maps. Stepwise demagnetization of the remanence-induced Fe₃O₄ particle upon heating to above the Curie temperature, performed in a similar fashion to bulk thermal demagnetization measurements, revealed that its vortex state remains stable under heating close to its unblocking temperature and is recovered upon cooling with the same or reversed vorticity. Hence, the PSD Fe3O4 particle exhibits thermomagnetic behavior comparable to a single-domain carrier, and thus, vortex states are considered reliable magnetic recorders for paleomagnetic investigations.

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