

The application of Lorentz transmission electron microscopy to the study of lamellar magnetism in hematite-ilmenite

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ABSTRACT

Lorentz transmission electron microscopy has been used to study fine-scale exsolution microstructures in ilmenite-hematite, as part of a wider investigation of the lamellar magnetism hypothesis. Pronounced asymmetric contrast is visible in out-of-focus Lorentz images of ilmenite lamellae in hematite. The likelihood that lamellar magnetism may be responsible for this contrast is assessed using simulations that incorporate interfacial magnetic moments on the (001) basal planes of hematite and ilmenite. The simulations suggest qualitatively that the asymmetric contrast is magnetic in origin. However, the magnitude of the experimental contrast is higher than that in the simulations, suggesting that an alternative origin for the observed asymmetry cannot be ruled out. Electron tomography was used to show that the lamellae have lens-like shapes and that (001) planes make up a significant proportion of the interfacial surface that they share with their host.

Keywords: Hematite, ilmenite, lamellar magnetism, Lorentz electron microscopy, electron tomography, transmission electron microscopy