Electron holography of chondrule dusty olivine

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Dusty olivine grains found within unequilibrated chondrites have the potential to have recorded early Solar System magnetic fields [1]. Understanding of the magnetic fields present during this period is crucial to models of the protoplanetary disk [2]. Estimates of the palaeomagnetic field from dusty olivine suggest magnetic fields played an important role in turning the protoplanetary disk into a planetary system [3]. Off-axis electron holography is a transmission electron microscopy technique that can be used to generate a magnetic induction map of the sample at the nanoscale [4]. Using electron holography, synthetic dusty olivine has proven to be a credible recorder of palaeomagnetic fields [5]. A recent study demonstrates that vortex state magnetite is capable of recording reliable thermoremanent magnetization [6]. Dusty olivine was prepared for TEM analysis by focused ion beam milling lamellae from a polished section of Bishunpur (BM 80339) onto DENS Solutions heating chips. We find highly magnetic, non-interacting vortex structures within the chondrule dusty olivine Fe metal. By heating the lamella in-situ up to 800°C and cooling back to room temperature, we present observations of the remanent magnetisation of dusty olivine up to the Curie point to investigate its nanoscale thermoremanent stability and credibility as a palaeomagnetic recorder.