In-situ heating 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. Understanding of the magnetic fields present during this period is crucial to models of the protoplanetary disk. Estimates of the palaeomagnetic field from dusty olivine suggest magnetic fields played an important role in turning the protoplanetary disk into a planetary system. 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. Using electron holography, synthetic dusty olivine has proven to be a credible recorder of palaeomagnetic fields. A recent study demonstrates that vortex state magnetite is capable of recording reliable thermoremanent magnetization. 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℃ 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.