

**Formation conditions of fine-grained inclusions inferred from their REE patterns.**

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Rare earth elements (REEs) in refractory inclusions often show large fractionation, which suggests that gas-dust (fine-grained particles) separation frequently occurs in the early hot solar nebula. In particular, Group II REE pattern with depletions of ultra-refractory heavy REEs (HREEs) can be explained by condensation from the fractionated gas after removal of HREE-enriched ultra-refractory dust. We have performed ion microprobe analyses of REEs in fine-grained inclusions from the Ningqiang (CV or CK anomalous), Y81020 (CO3.05), or Efremovka (CV3-reduced group) carbonaceous chondrites. We found that fine-grained inclusions often show positive Ce-Eu-Yb anomalies. Our earlier interpretation for these anomalies is that they formed in a condition similar to that for the Group II pattern, but at slightly lower temperatures, where not only ultra-refractory HREEs but also some LREEs condensed and removed from the system. However, this would result in almost complete removal of HREEs, which is not consistent with the observation. We therefore consider that the positive Ce-Eu-Yb anomalies were more likely produced by later condensation of these elements when fine-grained inclusions or their precursors (possibly fine-grained dust) moved into a Ce-Eu-Yb gas rich region. Such migration of solid materials may be frequent in the early solar nebula.