SIZE SORTING AND METAL-SILICATE FRACTIONATION IN ENSTATITE CHONDRITES. A. Kracher[1], P. H. Benoit[1], D. M. Thomas[1,2], and D. W. G. Sears[1], [1]Center for Space and Planetary Sciences, University of Arkansas, Fayetteville AR 72701, USA; [2]Southwest Missouri State University, 901 S. National Ave., Springfield, MO 65804-0089. akracher@uark.edu.

The EH chondrites have the highest Fe/Si ratio and the smallest chondrule sizes of all major chondrite groups. Previous work has shown that both metal and chondrule sizes are smaller in EH than in EL chondrites [1]. This adds to the evidence that the size distributions of metal and chondrules in the major chondrite groups may be related. It further suggests a common mechanism may not only have been responsible for size sorting, but also for the bulk metal/silicate fractionation in enstatite, ordinary, and reduced carbonaceous chondrites.

In order to elucidate the nature of this mechanism we have performed gas fluidization experiments on sand/iron mixtures with grain sizes relevant for enstatite chondrites. The method was identical to the one used earlier for mixtures simulating ordinary chondrites [2]. Mixtures of varying proportions of 300-425 μm quartz sand and <53 μm iron filings were used, approximately simulating the chondrule and metal sizes in EL chondrites [1]. Fluidization occurs at moderate gas flow, leading to separation of metal from silica for all mixtures with <30 % metal by volume (<55 weight%). Because of its smaller grain size metal rises to the top of the fluidized bed.

Theoretical calculations show that on asteroids fluidization of both metal and chondrules would occur with moderate gas flow velocities, about 0.1 cm/s at grain sizes relevant for EL chondrites, and 0.01 cm/s for EH grain sizes. These values are only weakly dependent on parent body size: for parent bodies between 50 km and 300 km radius the gas flow velocity required for fluidization varies only by a factor of 2-3.

We conclude that fluidization is an efficient mechanism for size sorting and metal/silicate fractionation on asteroids, and only minor amounts of interior volatiles are required to achieve the necessary gas flow rates. Furthermore, asteroids which contain interior volatiles and a regolith composed of roughly chondritic mineralogy and grain sizes would eventually acquire a metal-rich surface due to intermittent fluidization. This process could occur even on asteroids whose silicates are FeO-poor. It could account for the reddish spectra of M class and some E class asteroids which apparently contain insufficient FeO to form nanophase metal due to space weathering [3]. Surficial metal enrichment due to fluidization should be further investigated as an alternative mechanism to space weathering [4] or impact melting [5] as cause for the reddened spectra of “chondritic” asteroids.

References: [1] Schneider *et al.* (1998) *Meteoritics & Planet. Sci. 33*, A136. [2] Huang *et al.* (1996) *JGR 101*, 29,373. [3] Gaffey *et al.* (1993) *Meteoritics & Planet. Sci. 28*, 161. [4] Pieters *et al.* (2000) *Meteoritics & Planet. Sci. 35*, 1101. [5] Gaffey & Gilbert (1998) *Meteoritics & Planet. Sci. 33*, 1281.