The relationship of zoned and unzoned metal in CH and CB chondrites

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The formation processes of the unusually metal-rich CB and CH chondrites are highly debated. Parallel Ni and Fe isotope profiles and concentrations of refractory elements indicate that zoned metal from these meteorites formed by condensation [1]. Unzoned metal grains are also thought to have formed by condensation [2]. However, the setting of condensation is controversially discussed: solar nebula [3] *vs*. impact-induced vapor plume [4]. We found that W in zoned metal grains is depleted relative to other refractory elements which is suggestive for elevated oxygen fugacities in the gas reservoir, and thus, also for an impact event [1]. However, it is still unclear how condensation in such an impact plume proceeded and how zoned and unzoned metal grains are related with each other.

Investigation of Fe and Ni isotope-, and trace element composition of zoned and unzoned metals, via *fs*LA-ICP-MS analyses, suggest condensation of zoned and unzoned grains under different conditions. While the cores of zoned metals reveal significantly lighter Fe and Ni isotope compositions than unzoned grains, most of their rims are isotopically similar to unzoned metal. Combined results of isotope and trace element analyses reveal that the condensation process of zoned metal was generated during kinetic fractionation-dominated condensation. These conditions are expected in a fast cooling exterior envelope of an impact plume. Unzoned metal grains predominantly condensed in the slowly cooling interior of an impact plume under more equilibrium-like conditions. Compositional differences among metal grains are derived from the condensation trend and may also indicate turbulent gas mixing as is typically expected for an impact plume.

[1] Weyrauch et al. (2016) *MetSoc* LPI#1921 [2] Newsom and Drake (1979) *GCA* **43**, 689-707. [3] Weisberg and Prinz (1999) *24th Symposium on Antarctic Meteorites*, 187-198. [4] Kallemeyn et al. (2001) *LPSC* #2070.