Cr isotopic compositions of Chondrules from Murchison (CM2) and EET 92042 (CR2) chondrites

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Chondrules are one of the most important components of chondrites and are possibly the remnants of the building blocks of planetary embryos and terrestrial planets. Being among the oldest solids in the Solar System, chondrules are also important records for the early evolution of the Solar System. However, their ages and origins are still highly debated. The Cr isotopic system could provide key constraints on these issues, as the ^{53}Mn-^{53}Cr short-lived radiochronometer ($t_{1/2}$ = 3.7 Myr) is very useful for investigating the timescales of early Solar System processes that occurred within the first 10 Myr after CAIs [1]. In addition, the ^{54}Cr anomalies can be used to trace the origins of chondrules [1].

In this study, we present new Cr isotopic data for 11 chondrules from the CM2 Murchison and 8 chondrules from the CR2 EET 92042. Murchison and EET 92042 chondrules define two ^{53}Mn-^{53}Cr isochrons, with initial ^{53}Mn/^{55}Mn ratios of (6.8 ± 3.3) × 10^{-6} and (4.7 ± 1.2) × 10^{-6}, respectively. These corresponds to ages of 4567.4 ± 2.7 Ma (-0.1 ± 2.7 Myr after CAIs) and 4565.4 ± 1.4 Ma (1.9 ± 1.4 Myr after CAIs), respectively, when anchored to the angrite D'Orbigny. These ages reflect the formation times of the chondrule precursors in the two chondrites. Combined with previous results, the Mn-Cr fractioncations recorded in CO [1], CM, and CV [2] chondrule precursors were established at about the same as the formation of CAIs, but CR chondrule precursors were formed considerably later, around 2 Myr after CAIs formation. For both chondrites, the ε^{54}Cr and ε^{53}Cr values are positively correlated but follow different slopes, suggesting material mixing in the protoplanetary disk before the formation of chondrules precursors.

References: [1]Zhu et al. (2019) *ApJ* **873**, 82. [2]Yin et al. (2009) *LPSC* **#2006**.