^{60}Fe in the early solar protoplanetary disk

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Iron-60 ($t_{1/2}$=2.62 Myr) have proven to be one of the significant tools to study the evolution of early solar system [1]. A high ^{60}Fe/^{56}Fe ratio in meteorites would imply the birth of the solar system to the explosion of a nearby supernova. However, the initial ^{60}Fe abundance at CAI condensation as well as its homogeneity was controversial according to the results from different meteorites. Solving the issue of abundance and distribution of ^{60}Fe in multiple early solar materials is critical to assess the plausibility of the scenario of supernova-triggered solar system formation.

To study this issue, we have measured the Ni isotopic compositions of bulk HEDs, angrites and mineral separates from quenched angrites D'Orbigny and Sahara 99555 [2]. According to the correlation between ^{60}Ni isotopic ratio and Fe/Ni ratio, ^{60}Fe/^{56}Fe ratios obtained in isochrons range from 2×10^{-9} to 3×10^{-9}. Depending on the Mn-Cr ages of HEDs and angrites, the initial ^{60}Fe/^{56}Fe ratio can be estimated to be ~1×10^{-8} at CAI formation. Moreover, chondrules and mineral separates from CB_a chondrite (Gujba) as well as two ordinary chondrites Semarkona (LL 3.0) and NWA 5717 (ungrouped 3.05) were also studied. No resolvable ^{60}Ni excesses were observed in NWA 5717 or Gujba, giving an upper limit of ^{60}Fe/^{56}Fe initial ratio of 3×10^{-8} in the early solar nebula. Resolvable ^{60}Ni excess was found in one Type II chondrule from Semarkona with high Fe/Ni ratio, translating into an initial ^{60}Fe/^{56}Fe ratio at CAI formation of ~1×10^{-8} in the region where Semarkona formed. Therefore we conclude that ^{60}Fe was presented in a low abundance and well-mixed in the early solar system, implying that ^{60}Fe could have been simply inherited from interstellar medium that made the solar system. On the other hand, a nearby stellar source for ^{26}Al is still required. We favor the scenario of injection by stellar winds from one or several massive stars since ^{26}Al can be decoupled from ^{60}Fe successfully and transported into the parent nebula for solar system [3].

[1] Dauphas & Chaussidon (2011) *AREPS* **39**, 351; [2] Tang & Dauphas (2012) *EPSL* **359-360,** 248; [3] Gounelle & Meynet (2012) *A&A* **545,** A4.