^{26}Al–^{26}Mg mineral isochrons of nebular condensates from the Efremovka CV3

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Ca-Al-rich inclusions (CAIs) in meteorites, the oldest objects formed in the Solar System [1], likely formed near the protosun [e.g. 2]. Many CAIs contained detectable live ^{26}Al, a short-lived radionuclide with a half-life of ~0.7 Myr, at their formation [3]. Recent high-precision ^{26}Al–^{26}Mg mineral isochron studies using secondary ion mass spectrometry (SIMS) offer detailed distributions of initial ^{26}Al/^{27}Al values, $(^{26}Al/^{27}Al)_0$, for individual CAIs [e.g. 4, 5]. In this study, we newly obtained ^{26}Al–^{26}Mg mineral isochrons for two nebular condensates, a fine-grained spinel-rich inclusion and a fluffy Type A CAI, from the Efremovka CV3 by using SIMS.

The obitaned ^{26}Al–^{26}Mg mineral isochron of the fine-grained spinel-rich inclusion gives $(^{26}Al/^{27}Al)_0 = (5.16 \pm 0.22) \times 10^{-5}$. This is essentially identical to the canonical value determined by whole-rock ^{26}Al–^{26}Mg isochron studies for CAIs [6, 7] as well as initial values for nebular condensates from literature [4]. On the other hand, the ^{26}Al–^{26}Mg mineral isochron of reversely zoned melilite crystals in the fluffy Type A CAI gives $(^{26}Al/^{27}Al)_0 = (4.39 \pm 0.13) \times 10^{-5}$, which is significantly lower than the canonical value. Reversely zoned melilite crsytals in a fluffy Type A CAI from the Vigarano CV3, V2-01, showed $(^{26}Al/^{27}Al)_0 = (4.69 \pm 0.13) \times 10^{-5}$, which is also slightly lower than the canonical value [5]. The initial ^{26}Al/^{27}Al values for the observed nebular condensates range from (5.16 ± 0.22) to $(4.39 \pm 0.13) \times 10^{-5}$. This range corresponds to a formation age spread of 0.16 ± 0.05 Myr, similar to that for melted-CAIs of ~0.2 Myr inferred from ^{26}Al–^{26}Mg mineral isochrons of individual melted-CAIs showing a range of $(^{26}Al/^{27}Al)_0$ from ~5.2 to ~4.2×10^{-5} [4]. These data imply that nebular condensates formed contemporaneously with the melted-CAIs during ~0.2 Myr from the canonical age.

[1] Connelly et al. (2012) *Science* 338, 651−655. [2] McKeegan et al. (2000) *Science* 289, 1334–1337. [3] MacPherson et al. (1995) *Meteoritics* 30, 365–386. [4] MacPherson et al. (2012) *EPSL* 331−332, 43−54. [5] Kawasaki et al. (2017) *GCA* 201, 83−102. [6] Jacobsen et al. (2008) *EPSL* 272, 353−364. [7] Larsen et al. (2011) *ApJL* 735, L37−L43.