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Reduction of ^{146}Sm-^{142}Nd chronology in the early solar system

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The ^{146}Sm, as an extinct p-process isotope, plays an irreplaceable role in the time-line construction of the early solar system (ESS) and the geochemical tracing via its α decay to ^{142}Nd. However, the measured half-life of 146Sm is still debated, which can result in a large uncertainty in the initial 146Sm abundance in the ESS and subsequent dating of planetary events after the birth of the Sun. In this study, this half-life is reported to be 64.2±10.1 million years based on a comprehensive analysis via both the state-of-the-art techniques on the α decay process and the local extrapolation from neighboring isotopes. More importantly, this procedure is actually regardless of the α-daughter potential, convincing a model-independent half-life of ^{146}Sm. The initial ^{146}Sm/^{144}Sm ratio of 0.0094−0.0003 +0.0005 at 4568 Ma, corresponding to the formation of solar system, is then determined, further leading to a reduced timescale for various planetary silicate mantle differentiation events of the ESS, paving the way for a calibrated ^{146}Sm-^{142}Nd chronometer in future studies of nucleosynthesis, earth and planetary astrophysics.

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