Determination of precise nickel isotopic composition and natural nickel isotopic variation by ICP-MS

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Our recent isotopic analysis revealed a significant natural isotopic variation among readily available zinc reagents due to distillation purification process to produce high purity zinc metal [1]. Similar distillation process is often used to produce high purity nickel, and the isotopic variation among terrestrial natural samples has been measured by inductively coupled plasma mass spectrometry. The time-independent characteristic of the mass spectrometry against the mass discrimination allowed the precise analysis of nickel isotope ratios, which yielded the precisions of 0.01 %, 0.03 %, 0.01 % and 0.09 % for $^{58}Ni/^{60}Ni$, $^{61}Ni/^{60}Ni$, $^{62}Ni/^{60}Ni$, and $^{64}Ni/^{60}Ni$ ratios, respectively, after normalizing $^{65}Cu/^{63}Cu$ ratio to 0.4456 [2] to correct the mass discrimination effect.

Their difference was equivalent to the isotopic variation of zinc metal purified through only electrolysis (less than 0.3 permil/amu), which includes an extra-terrestrial Ni variation [3], and fairly smaller than that of high purity Zn metal through distillation process (1.2 permil/amu) [1].

No isotopic difference was observed from the variation of nickel sulfide minerals, which are the principal resource of industrial nickel. This indicates the Ni isotopic variation in nature is comparable to that through industrial purification, or the variation among Ni reagents may be controlled by the isotopic compositions of Ni source minerals.

References

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