Accurate Measurement of Isotope Ratios of $^{30}Si/^{29}Si$ in Kaolin and Alumina with multicollector inductively coupled plasma mass spectrometry

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Isotope ratios of $^{30}Si/^{29}Si$ for silicon in kaolin and alumina samples have been measured using multicollector inductively coupled plasma mass spectrometry (MC-ICP-MS). The mass fraction of silicon in alumina was also measured using isotope dilution inductively coupled plasma mass spectrometry (ID-ICP-MS). With the isotope ratio of $^{30}Si/^{29}Si$ and the mass fraction of silicon, the Vertual Element theory was tested for determining isotope composition of silicon in alumina samples. The completeness of dissolution method for kaolin and alumina were evaluated using a alumina reference material NMIJ CRM 8007-a and stepwise digestion method including microwave-assisted acid digestion with the hydrofluoric acid and nitric acid after dissolution at 210 °C with a mixture of sulfuric acid and phosphoric acid was selected as the method of choice for isotope ratio measurements of silicon. The measured mass fraction of silicon for the reference material showed good agreement with the certified values, 17.07 mg/kg ± 0.38 mg/kg (k=2, corresponding to an estimated confidence interval of approximately 95 %). The instrumental isotope fractionation of silicon in MC-ICP-MS measurement was corrected by the external correction factor obtained from the K factor measurement using blend solutions of natural silicon, ^{29}Si and ^{30}Si-enriched solutions. The $^{30}Si/^{29}Si$ isotope ratios of silicon in kaolin and alumina samples were in the range of 0.6638 ± 0.0002.