Intercomparison of $\delta^{26}$Mg values in Mg isotope RMs and standards to a new isotope RM traceable to the SI

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Accurate measurements of stable isotope abundance ratio variations are often reported using artifact based $\delta$-scales, which rely on suitable isotopic reference materials (iRM) for their realization. For example, variations in the $^{26}$Mg/$^{24}$Mg isotope abundance ratio in natural systems are typically reported as $\delta^{26}$Mg values that represent the relative difference between the $^{26}$Mg/$^{24}$Mg ratio measured in a sample relative to its measurement preferably in an iRM. In the past, such $\delta^{26}$Mg measurements were referenced to NIST SRM 980, the initial zero of the $\delta^{26}$Mg scale. With the development of MC-ICPMS, the detection of small but measurable isotopic differences in different chips of SRM 980 became apparent. It was then replaced by an Mg solution (DSM3), the new zero of the $\delta^{26}$Mg scale. A potential replacement iRM for DSM3 has been developed, ERM-AE143. This iRM has also been measured for its absolute isotope amount ratios1,2 making it traceable to the SI.

The results of our $\delta^{26}$Mg intercomparison experiment include the Mg iRMs SRM 980, IRMM-009, ERM-AE143, AE144, AE145 standards DSM3 and Cambridge-1. The intercomparison involved 5 expert laboratories, consisting of 3 metrological institutes (BAM, NIST, PTB) and 2 scientific research laboratories (GFZ Potsdam, U-Bremen).

The iRMs were measured relative to AE143 and cover a range of $\pm 5$ % in $\delta^{26}$Mg. IRMM-009 has the lowest $\delta^{26}$Mg value while DSM3 has the highest, spanning a range in values that covers natural Mg isotope variations. The 2SD reproducibilities of the individual values from the different laboratories range from 0.02 to 0.26 %. The mean $\delta^{26}$Mg values, calculated from the laboratory means however show 2SD reproducibilities varying between 0.03 and 0.10 %. Propagated measurement uncertainties suggest a standard uncertainty of about 0.1% for $\delta^{26}$Mg determinations.

1 JAAS, 2015, 31,179; 2 JAAS, 2016, 31, 1440
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