Stable isotope analysis using molecular absorption spectrometry

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We propose an alternative faster and low-cost optical method for isotope analysis: high-resolution continuum source molecular absorption spectrometry (HR-CS-MAS).

Stable isotope amount composition of X = Li, B, Mg, Ca and Sr were determined by monitoring the absorption spectra of their in situ generated mono-hydrides (XH) in graphite furnace HR-CS-MAS. Isotopes of boron (^{10}B and ^{11}B) were studied via their hydrides for the electronic transition $X^1\Sigma^+ \rightarrow A^1\Pi$ (Fig. 1a). The spectrum of a given sample is a linear combination of the ^{10}BH molecule and its isotopologue ^{11}BH. Therefore, the isotopic composition of samples can be calculated by a partial least square regression (PLS). For this, a spectral library is built by using samples with known isotope composition. Results with an accuracy of 0.15 ‰ are metrologically compatible with those reported by mass spectrometric methods [1]. Similar results are obtained for *n* isotope systems like Mg (^{24}Mg, ^{25}Mg, and ^{26}Mg), where isotope shifts of their isotopologues can be resolved as shown in Fig.1b. The extension of this methodology to other elements like Li, Ca and Sr is discussed [2].

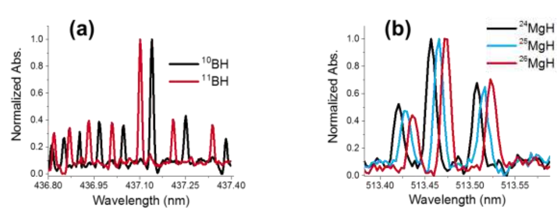

Fig.1. (a) Comparison of the average spectra of ^{11}BH (^{11}B relative isotope abundance 99%) and ^{10}BH (^{10}B 98%). (b) Comparation of the spectra of ^{24}MgH, ^{25}MgH and ^{26}MgH.

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