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# Multiple sulfur isotope determination on $SO_2$ gas

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The principal motivation of this study is to apply $SO_2$ gas in the multiple isotope analysis (i.e. simultaneous analysis of sulfur isotope ratios: 33S/32S , 34S/32S and 36S/32S) rather than SF6 gas. $SO_2$ gas can be easily prepared from sulfides (Robinson and Kusakabe 1975) and from sulfates (Halas and Wolacewicz 1981), whilst the preparation of SF6 gas requires the use of a fluorination line (Ono et al. 2006) and a mass spectrometer with enhanced resolving power to resolve isotope peaks 33SF5- from 32SF5- (masses 128 and 127).
In the patent application (Halas et al. 2016) we have described a new ion source which can be applied for analysis of gases. The new ion source significantly enhances generation, both positive and negative, ions in comparison to commonly used Nier type. The analyzed gas is admitted from a dual inlet system to the ion source through separate capillaries connected to the pneumatically operated changeover valve as described by Halas (1979).
It is important to have $SO_2$ samples well purified from volatiles which eliminates $O_2$ interference at mass 32 peak. A great advantage of the isotope analysis on S+ instead on SO+ or $SO_2$+spectra is that there is no need to keep constant oxygen isotopic composition in the $SO_2$ gas. Usually sulfide and sulfate samples have different oxygen, but it doesn't matter in the case of analysis on S+.
The achieved precision ($1\sigma$) on positive ion beams was better than 0.1‰ and 0.01‰ for $\delta$36S and $\delta$34S, respectively. Unfortunately $\delta$33S cannot be measured in this way, because of formation of 32SH+ ions which interfere with 33S+. The details of the design of the ion source, vacuum system and electronic controllers are presented in the poster.
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