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SGC55-P01 会場:コンベンションホール 時間:5 月 23 日 15:30-17:00

200nm フェムト秒レーザーアブレーション SF-ICPMS 元素分析法によるマトリクス効果の低減
Origin of Suppressed Matrix Effect by 200Fs-SF-ICPMS Elemental Analysis

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We have tested an ultraviolet 200nm femtosecond laser ablation (200FsLA) sector-field inductively coupled plasma mass spectrometry (SF-ICPMS) system for major and trace element analyses in silicate glasses and minerals. By optimizing the 200FsLA optics and the analytical protocol and employing a modified ion sampling interface in the SF-ICPMS, the sensitivity of the system has been improved with reduced backgrounds, achieving accurate spot analyses of 44 elements from ppb to wt.% levels at a crater diameter of 30 microns. Corrections for differences in the laser sampling efficiency between samples and the standards were performed by 100% normalization of the sum of the oxides of all the elements analyzed. Use of 200FsLA minimized the matrix effect by 50% compared to that by a 193-nm nanosecond excimer LA. The origin of this improvement was identified as the suppression of melting point-induced element fractionation at the laser ablation site due to a decreased thermal effect by 200FsLA. Sensitivity enhancement in some elements with high first ionization energy still remained in the basalt aerosols relative to silica-rich aerosols. This is inferred to be due to the higher thermal conductivity of the basalt aerosols in the inductively coupled plasma enhancing ionization. Accurate determination of trace elements (within 5% of the accepted values) was achieved for glasses ranging from MPI-DING komatiite to rhyolite, using single basalt glass BHVO-2G as the calibration standard. This method is also applicable to various anhydrous silicate minerals such as plagioclase, pyroxenes, and garnet. However, SRM610 glass, which has a very different matrix than BHVO-2G, is preferred for zircon. Apart from this exception, the proposed method does not require any external analytical techniques when the amounts of unmeasured elements such as halogens or water in the materials are negligibly low, which is the case for many geological materials.

キーワード: フェムト秒レーザーアブレーション, ICP-MS, 元素分析, マトリクス効果
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