

Chemical state of Fe in Asama lava using high resolution X-ray fluorescence

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If someone wishes to analyze the chemical state of Fe without destruction of the sample, the Moessbauer spectroscopy is only method for practical use. However, this method has not so high sensitivity, and possible utilizing place has been limited due to the necessarily of radioisotope. On the contrary, X-ray fluorescence spectroscopy (XRF) is so wide use method for qualitative and quantitative analysis as well known. And, it was already reported on several fields that the spectrum profile of characteristic X-ray obtained by high resolution measurement shows the change in proportion to the chemical state. Using this phenomenon, the chemical state of any element can be decided. In this report, the application result of this high-resolution X-ray fluorescence spectroscopy (HRXRF) for the chemical state analysis of Fe in the lava samples of Asama volcano was presented. The HRXRF spectra were measured by RIGAKU 3580E3 double crystal type spectrometer. The standard samples for assignment of chemical state were Fe₂O₃ for Fe(III) and FeTiO₄ for Fe(II).

From the comparison between the of Fe Ka₁ spectra of two standard samples, the peak position of FeTiO₄ (Fe(II)) was 0.10eV higher than that of Fe₂O₃ (Fe(III)). On the other hand, the peak position Fe Ka₁ of the lava sample obtained at Onioshidashi lava appeared between the positions of these two standards, 0.07eV higher than Fe₂O₃, and the width of the peak was also broader than Fe₂O₃. Then, the peak separation technique with measured spectra for components spectra were adopted to this spectrum, and it was found that Fe(II) : Fe(III) was 64:36 with the sufficient precision of the calculation. In addition, two scoria samples obtained from Asama B dash scoria fall deposit were also analyzed with same process, and it was also found that the amount of Fe(III) existed further than Fe(II).