Is the non-destructive analysis of carbon isotope ratio useful?

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Carbon is an important volatile element that has had a great influence on the environment of the Earth's surface through the history. Carbon dioxide has a greenhouse effect gas and this gas exhausted by our production activities is regarded as a cause of modern global warming.
Carbon dioxide is observed as the fluid inclusions in the mantle xenolith that is derived from deep earth. A paper reports that the integral exhaust amount of carbon from the deep earth is equal to the amount of the carbon that exists on the Earth's surface in present. Therefore it is important for the discussion of environmental issues to understand the origin of the deep earth carbon and the cycle of carbon using mantle xenolith.
The modern sampling method of carbon dioxide fluids (Crushing method) has two problems, the destruction of the samples and the shortage of the spatial resolution. The measurement of carbon isotope ratio using Raman spectroscopy has a possibility to break through those problems. However, this method hasn't had the precision to be able to discuss the origin of carbon dioxide fluids yet. In this study, we tried to improve the precision of the measurement of carbon isotope ratio using Raman spectroscopy using a micro-Raman spectrometer with high spectral resolution. Moreover, we discuss the cause of uncertainty depends on the result of measurement and the prospects for the future.
As a result of measurement, the uncertainty of this method is revealed ±26‰ (1 σ) at 1500 sec. A reason of this bad uncertainty is the shortage of sensitivity of the Raman spectrometer. The lowness of signal noise ratio (S/N) with the low sensitivity causes a lack of precision of the peak fitting. We can estimate the ultimate precision of this method by assuming an infinite peak count using regression line. For the analytical system of this study, the limit value is ±11‰ (1 σ), which is still worse than the precision to be able to discuss the origin of carbon in mantle xenolith.
The factor of this error is revealed the apparent Raman shift depends on the changing of room temperature. If it does not exist, the precision can improve to discuss the origin of deep carbon.

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