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地球深部物質の高温高圧実験に向けた CO_2 レーザー両側加熱装置の開発
Double CO_2 laser heating system for high P-T experiments of the deep Earth's materials in a diamond anvil cell

大西 里佳 [1*], 木村 友亮 [1], 桑山 靖弘 [1]
Satoka Ohnishi[1*], Tomoaki Kimura[1], Yasuhiro Kuwayama[1]

[1] 愛媛大学地球深部ダイナミクス研究センター
[1]Geodynamics Research Center, Ehime University

A laser heated diamond anvil cell (LHDAC) has been widely used for understanding the behavior of materials under the high pressure and temperature conditions of the Earth's and planetary deep interiors. Near IR lasers such as YAG, YLF and fiber lasers, with a wavelength of about 1 micrometer, are generally used for LHDAC experiments. However, they are unsuitable for heating transparent materials including MgO, $MgSiO_3$, SiO_2 and $CaSiO_3$ without metal absorbers. The CO_2 laser with wavelength of about 10 micrometer enables to directly heat these materials. For laser heating system using near IR lasers, the double-sided laser heating technique has been improved to reduce the temperature gradients in the sample. Here, we developed a double-sided heating system using the CO_2 lasers for high P-T experiments of the mantle materials in a DAC.

The system consists of two CO_2 lasers, optical systems to focus the lasers and monitor the sample and a spectroradiometric system for temperature measurements. By using lenses designed for the CO_2 laser wavelength, the laser paths are separated from optical paths for collecting thermal radiation and visual observation because the collecting lenses made of SiO_2 glass high absorption of the wavelength. The both side lasers can be controlled separately. Two dimensional image of the sample are observed by CCD camera. Temperatures are measured by using the spectrometer. The heated position was synchronized with observed position by both CCD camera and spectrometer.

We will report the heating experiments of oxide by using developed double-sided CO_2 laser heating system.