# Induction heating HT diamond anvil cell for Raman microspectroscopy

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A high temperature diamond anvil cell by high frequency induction heating (IH-DAC) was newly constructed for Raman microspectroscopy. DAC is widely used high pressure apparatus to investigate the depth of the Earth. Two heating methods are often adopted to heat a tiny sample in DAC. One is external heating DAC with electrical heater surrounding diamonds. This is easy way to heat sample, but not easy to avoid some experimental difficulties such as the breaking of the electrical wire. The other is internal heating method by laser. This is very refined way of heating sample in gasket. However, laser heating DAC costs a lot and may encounter unstable heated states of sample. In this study, we adopted an induction heating as elevating temperature of DAC. The IH-DAC will possibly be a modified external heating method to heat DAC stably. The IH-DAC was designed as modifying the Merrill-Bassett DAC as to apply pressure with a lever. The modified DAC was made by Engineering Workshop of Osaka City University. One turn of induction coil was made for IH-DAC by Nippon Thermonics Co., LTD. A pair of diamonds is surrounded by a turn of induction coil. The temperature of a sample in gasket can be directly measured by Raman spectra. The intensities of Stokes (IS) and anti-Stokes (IaS) lines are related by Boltzmann factor as IaS/IS =exp(-hv/kT). Stokes and anti-Stokes lines of silicon were used for calibration of temperature.

As preliminary experiments, dummy plates of SUS, WC, Re were heated by IH. Temperature of dummies was measured by infrared thermometer. SUS was stably heated up to 1200C in air. Surface of WC reacted in air over 800C. Re evaporated over ca. 400C. Based on the dummy heating, Two kinds of parts setting composing DAC were examined for IH. As first setting, Rockers supporting diamonds were made from WC. The WC rockers are directly heated by the induction coil of Cu. In this way, a sample in gasket can be easily heated up to 800C. In the second, rockers were made from Si3N4, and hybrid gasket was made from Re plate sandwiched by welded SUS plates. In this way, whereas the hybrid gasket can be heated by IH, no heating effect for rockers. In this setting, high temperature was not attained as the former way. Therefore, heating directly rockers by IH is hopeful way to reach high temperature over 1000C. It is necessary to select materials of rockers and control atmosphere around DAC. Although some experimental difficulties must be overcome, IH-DAC is a useful method for HT-HP experiments. We will report some direct observation of high pressure phase transformation of minerals.