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Introduction to resistively heated DAC techniques

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This lecture will give an introduction to resistively heated diamond anvil cells (DAC) with illustration by several applications. On one hand side the Basset-type DAC, also known as the hydrothermal DAC, will be introduced. This cell is optimized for experiments using aqueous fluids as pressure medium or as sample. The sample chamber serves as an isochoric container and high P-T conditions (< 2 GPa, $< 800^{\circ}\text{C}$) are achieved by resistive heating and very precise temperature measurements ($\pm 0.1^{\circ}\text{C}$). P is usually determined from the EOS of the fluid. This cell is generally used for studying element speciation in fluids and solid-liquid equilibration experiments. On the other hand resistively DACs are used with solid pressure media to study properties of solids at very high pressure at elevated temperatures. In this case, either the complete DAC is resistively heated, by a heater put around the anvils or by a gasket heater. To avoid oxidation of metal parts and the diamond anvils the cell is set into a vacuum chamber. These cells may reach up to 1300°C and have been used to determine phase properties, phase relations, crystallization kinetics and sample deformation. Temperature is often measured on the outer side of the diamond, the pressure is measured by pressure markers using XRD or spectroscopy. The performance of both cell types is illustrated by several examples.