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Towards smarter high pressure cells: Integrated pressure calibration for individual heated multianvil experiments

Despite the impressive developments in the application of large volume presses at synchrotron facilities that are catching up with the long-established diamond anvil cell technique (DAC) for in-situ studies, still the vast majority of multianvil high pressure experiments (MAE) is and will be further performed at in-house facilities without any access to in-situ characterization based on X-ray or neutron beams. For traditional/conventional pressure calibration in MAE, the correlation between the pressure inside the pressure cell and the load applied to the press needs to be established by 'calibration' runs. With respect to pressure cell design and gasketing, this allows only for minor deviations from a once established 'standard assembly' without compromising the pressure scale. The objective of our development was to find a way of performing heated multianvil experiments with built-in pressure calibration for every single run. Based on previous results, we managed to accommodate one or more fixed-point calibrants together with a piezoresistive manganin gauge within octahedral pressure cells of various sizes, without interfering with the furnace assembly. The method gives the whole compression curve and the final pressure within the octahedron before heating. It moreover yields important information on the unloading path of the experiment. It does not only offer the possibility to combine room-temperature and high-temperature pressure calibration within a single experiment, but also proved to be a useful tool to speed-up testing of new multianvil assemblies and configurations.

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