



Towards a very low-friction assembly for piston cylinder: can we go below 150 MPa?

M. Masotta (1), F. Radica (2), C. Freda (3), T. Paul (4), G. Moore (5), M. Gaeta (1,3), P. Scarlato (3), V.R. Troll (3,6)

(1) Sapienza Università di Roma, Italy (matteo.masotta@uniroma1.it), (2) Università degli Studi Roma Tre, Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia, Italy, (4) Depths of the Earth Co., AZ, USA, (5) Arizona State University, USA, (6) Uppsala University, Sweden

The piston cylinder apparatus is one of the most versatile instruments operating in laboratories of experimental petrology because it provides a safe, inexpensive, and easy-to-use technique for accessing high-pressure and high-temperature phases and processes. The operating pressure of the piston cylinder usually ranges between 0.5 and 5 GPa, which allows Earth scientists to investigate materials and processes occurring at deep crustal to upper mantle levels. Incomplete compaction of the assembly and thermocouple failure are typical problems in experiments performed at pressures lower than 0.5 GPa.

We have demonstrated that, using proper assemblies, piston cylinder apparatus can effectively be used at pressure as low as 150 MPa. At this purpose, we have developed and tested a new 25 mm furnace assembly, made up of crushable MgO, borosilicate glass and NaCl. Calibration of the new assembly yielded to a significant increase of correction at lower pressure (an additional correction +60 MPa is required when operating at 150 MPa). With the aim to further decrease the operative pressure limit of piston cylinder below 150 MPa, we are testing a new “softer” assembly, in which the MgO sample holder has been replaced with a mixture of NaCl and KCl. The use of the softer material allows a better compaction of the assembly, maintaining an hydrostatic regime even for lower hydraulic pressure. Nevertheless, the softening/melting of the salt decreases the resistivity of the assembly, implying a higher operation current. This problem can be worked out by insulating the sample holder salt from the graphite furnace. The major advantage of using the new design 25 mm assemblies in the piston cylinder apparatus is that experiments for which low-pressure conditions as well as very fast heating and quenching rates are required (e.g. volcanic and hydrothermal systems), can be performed with the same ease and precision as for the pressure ranges for which piston cylinders are routinely employed.