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Pressure Calibration of a Tetrahedral Anvil Device

THE tetrahedral anvil high-pressure device was first described by Hall[1] in 1958. The pressure calibration of this device was based on the resistivity measurements of Bridgman[2]. Because the calibration points based on these measurements have been revised downward[3], the original linear plot of sample pressure versus applied force no longer has validity. In a preliminary determination of the shape of a calibration curve based on the newer values of the calibration points, curve *A* (Fig. 1) was obtained. These values were obtained with an apparatus containing 7-in. hydraulic rams and triangular tungsten-carbide anvils which were 0·781 in. in edge-length. The calibration wires were inserted in silver chloride cylinders 5/32 in. in diameter which in turn were inserted in the pyrophyllite tetrahedrons, which were about 25 per cent oversize (edge-length). A thick coating of iron oxide mixed with water was applied to the assembled tetrahedron before it was pressed. The use of tetrahedrons which were 35 per cent oversize caused the samples to be more distorted by the flattening of the ends of the silver chloride cylinders, as described elsewhere[4]. Tetrahedrons which were only 15 per cent oversize transmitted the applied force to the calibration wire less effectively. In this case about 10 per cent more ram force was necessary to attain 25 kbars on the calibration wire.

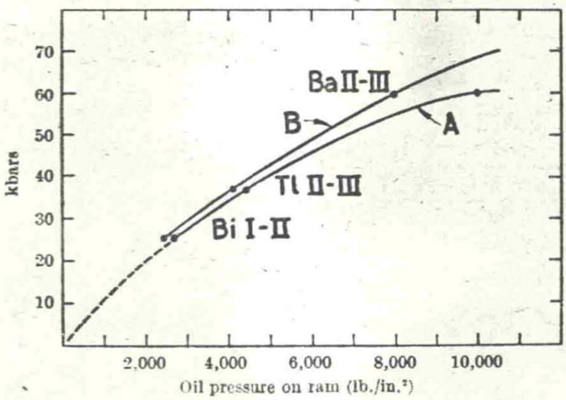

Fig. 1

Curve B (Fig. 1) was obtained under the same experimental conditions as here, except that the pyrophyllite tetrahedrons, completely assembled, were dried at 90° C for 2 h after the iron oxide was applied[5]. In addition to this substantial increase in efficiency, the deformation of the sample was reduced. Results obtained following this procedure were reproducible to about 1 or 2 per cent. It should be observed that the points on curve B can be connected by a nearly straight line which does not pass through the origin. Preliminary experiments indicate that sample porosity may reduce the efficiency of pressure transmission by 5–10 per cent.

The pressure-transmitting qualities of pyrophyllite can also be improved by heating the tetrahedrons to 650° C for several hours before the samples are assembled. This treatment causes the pyrophyllite to be about 10 per cent more efficient in pressure transmission. However, this procedure apparently reduces the elasticity of the pyrophyllite, because frequent blow-outs were observed on decreasing the applied pressure.

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