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Distribution of Pressure in an Opposed-Anvil, High-Pressure Cell[1]

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Apparatus

The distribution of pressure is determined from spectral data taken from microsections of a substance with a pressure-sensitive absorption band mounted in a diamond-anvil, high-pressure cell. Since the position of the absorption band is known as a function of pressure from independent measurements, each piece of spectral data can be converted to a pressure, to develop a pressure-contour map. A derivation of the expected pressure distribution is made in terms of the compressibility of the material. The equation developed to relate the pressure, P, at some point, r, along the radius of the diamond is

$$\frac{r_o^2 - r^2}{r_o^2 - r_a^2} = \frac{aP - bP^2}{aP_a - bP_a^2}$$

where

P_a is the applied pressure, r_a is the position along the radius corresponding to the applied pressure, and r_o is the radius of the diamond surface. Using further relations, we can evaluate r_a and the maximum pressure within the cell. These parameters depend on the applied pressure and the compressibility of the material. In general, the maximum pressure is about two times the applied pressure, which is realized at about $r_a = 0.7\, r_o$. The agreement with the experimental data is very satiisfactory. A method is described for determining compressibility from pressure-distribution data.

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