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Development of Miniature Diamond Anvil Cell for the Superconducting Quantum Interference Device Magnetometer

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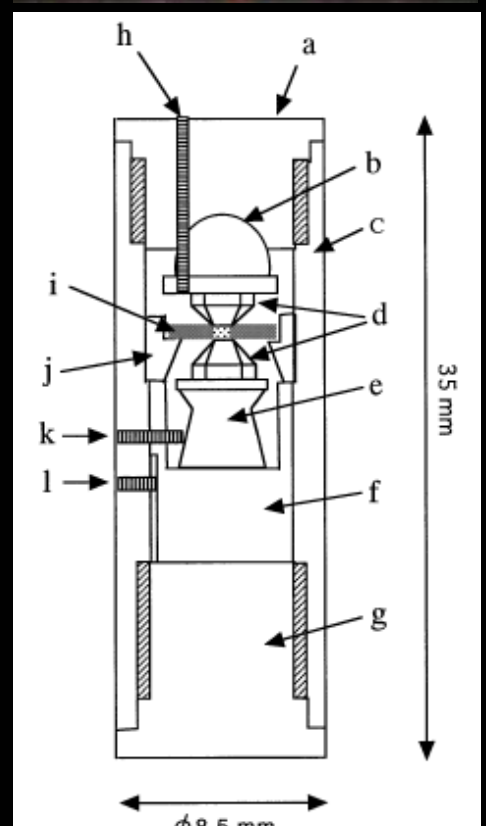
We have developed a novel miniature diamond anvil cell (mDAC) with a diameter of 8.5 mm and a length of 35 mm for a commercial superconducting quantum interference device (SQUID) magnetometer. In this mDAC, both X–Y and tilt adjustments of diamond anvil are possible. The SQUID magnetometer with this mDAC works under pressures higher than 1 GPa in a wide range of temperature and high magnetic field region. As for the test operation of this system, we first investigated the standard pressure effects of metallic superconductor Pb up to the pressure $P = 3.8$ GPa at the magnetic field $H = 100$ G and after that we investigated the pressure effect of an f-electron ferromagnetic compound $GdZn_2$ up to $P = 4.9$ GPa for $H \leq 20000$ G. The sensitivity of the present system is about 10^{-6} emu.



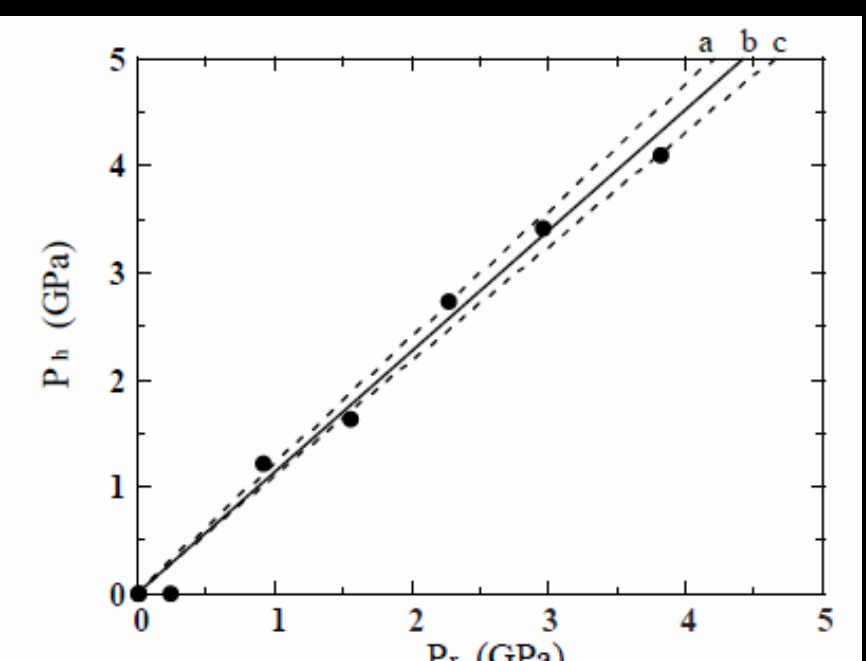


Fig. 3. Relationship between the pressure at room temperature (P_r) and that at liquid helium temperature (P_h). The broken and solid lines (a–c) show $P_h/P_r = 1.19$ (a), 1.14 (b) and 1.08 (c), respectively.

Fig. 1. Overall cross-sectional view of the miniature diamond anvil for the SQUID magnetometer. The main parts are (a) grand nut, half-sphere seat for the upper diamond, (c) cylinder, (d) diamonds, anvil plate for the lower diamond, (f) piston, (g) nut for applying pressure, (h) screw for tilt adjustments, (i) gasket, (j) supporter for the ga (k) screw for X–Y adjustments and (l) piston guide screw.