PRESSURE CALIBRATION OF A PISTON-CYLINDER DEVICE IN THE RANGE OF RELATIVELY LOW PRESSURES 4-20 Kbars

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Piston-cylinder devices with a solid pressure transmitting medium (talc, pyrophyllite) usually are used to generate pressures higher 20 kbar. At lower pressure friction losses becomes comparable with the level of generated pressure. Large friction increases the uncertainty of friction loss determination, which is resulted in high errors of pressure determination. To reduce friction losses in piston-cylinder device salt assembles (NaCl, CaF_2) which have a relatively low internal friction are used. Such salt assemblies allow to extend the pressure range of cylinder-piston apparatus in direction to low pressures down to few kilobars and partly substitute complicate hydrostatic equipment with internal heating usually used at pressures up to 15-20 kbar. At low pressures is necessary precisely estimate how much the real pressure on the sample differ from the value calculated as the ratio of the applied force to the piston area. For that purpose pressure dependence of KCl melting temperature obtained on increasing and decreasing pressure was investigated using ¾ of inch piston-cylinder devise. Melting temperature of KCl were detected by means of differential thermal analysis (DTA). KCl sample was placed in a welded Pt capsule. One Pt/Pt-10Rh thermocouple touched the wall of the capsule, the other one serves as a reference; heating rate was in the range 1-2° /sec. The plot of melting temperature dependence on pressure during increasing and decreasing pressure looks like as a hysteresis loop, Fig1. The width of the loop corresponds to the double friction value in assumption that in a salt assembly friction losses are essential symmetrical. Determined in such way friction losses are about 0.5-1 kbar for our salt assembly. The accuracy of estimation of the real pressure on the sample depends on the error of friction determination which in turn depends on the error of melting temperature determination (+3°C) under DTA measurements at high pressures. Taking into account that the results of various runs were consistent and the value of error of melting temperature measurements we obtained the total error of pressure estimation in the limits of 3-4%. Our data on pressure dependence of KCl melting temperature in quazihydrostatic conditions are in a good agreement with the results obtained under real hydrostatic pressures.

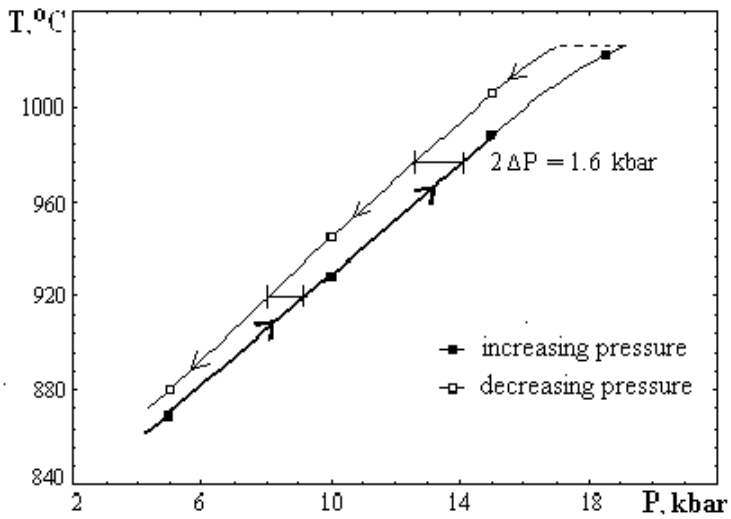

Fig. 1. Pressure dependence of KCl melting temperature.