

Fig. 4. The pressure calibration curve at high temperature (200–300°C), which was determined by the indirect method as described in "Discussion".

27.0kb were chosen. These transitions were noted on X-Y recorder as discontinuities of the electrical resistance. Manganin wire was used to note the linearity of calibration curve. The all experiments described above were made at room temperature and the results are shown in Fig. 3.

To calibrate applied pressure at high temperature (200–300°C), the melting curve of bismuth was utilized, which was obtained by the experiment of Kodama²⁾. At a given melting temperature, the melting of bismuth in a sample cell must occur at the same internal pressure in both compression run and decompression run. Therefore, if we increase the internal pressure along the calibration curve at room temperature noting melting points, and then, decrease pressure noting melting points, the calibrated decompression curve can be obtained. But, of course, this calibration curve includes the decreases of frictions in compression run and decompression run. The pressure calibration at high temperature may be performed by dividing these decreases into the part of compression run and that of decompression run. Further details will be explained in "Discussion". The calibration curve at high temperature obtained as described above is shown in Fig. 4, and the assembly for this experiment is shown in Fig. 2(c). One can see from Fig. 4, that the calibration curve at room temperature can be applied to high temperature (200–300°C) experiment.

Fig.'s 5 and 6 show the pressure distributions in the sample assemblies represented in Fig.'s 2(a) and 2(b). The positions of bismuths in the sample assemblies are plotted versus applied pressures, at which the phase transitions of bismuth occurred.

Fig. 2(c) shows a typical sample assembly to supply power. Temperature was measured by the thermocouple being in contact with the top of the sample capsule, and phase transitions were observed by the D.T.A. technique, another thermocouple was set at about 3mm high position from the top of the capsule. The thermocouples were made of chromel and alumel. Effect of pressure on the thermoelectric force was neglected.

We can see from Fig. 3, that the calibration curve in compression run is

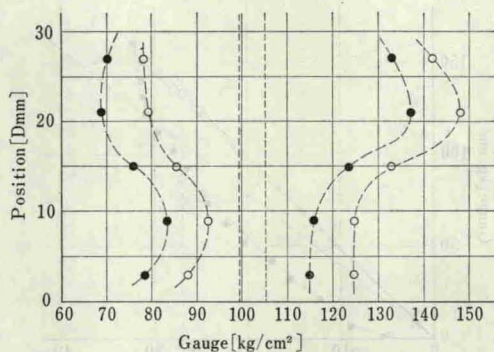


Fig. 5. The pressure distribution in vertical direction in the assembly of Fig. 2-(a). D's show the positions of bismuths measured from the bottom of the assembly.

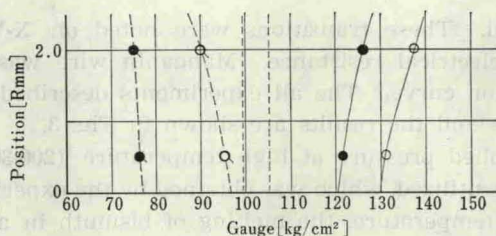


Fig. 6. The pressure distribution in radial direction in the assembly of Fig. 2-(b). R's show the positions of bismuths measured from the center of the assembly.

almost linear. But the linearity could not be verified at low pressure, because the values of electric resistance of manganin wire were scattered. We can see also from Fig. 3, that internal pressure remains high in the first of decompression run. The high value may be lowered in long time, but it may be too long for actual experiment.

The pressure calibration at room temperature can not be applied generally in high temperature experiment, because of changes in internal frictions of pressure transmitting materials and in frictions between the pressure transmitting materials and the face of the cylinder. Decker³⁾ proposed the equation of state of NaCl and its use as a pressure gauge in high pressure and high temperature research. But this precise equation is not useful as a pressure gauge for the apparatus like piston cylinder devices, because of the difficulty of measurement of the accurate volume change of NaCl at high temperature. Therefore, to calibrate pressure induced by piston cylinder devices at high temperature, an indirect method was made. Assuming that the effects of heat on the frictions are equal in both compression run and decompression run, the pressure calibration at high temperature is performed by noting a certain phase transition such as melting of a proper substance with weak dependence on pressure. In our