

Piston Cylinder Experiments

Measurements were made in the piston cylinder apparatus on chromel, alumel, platinum, and platinum-10 percent rhodium wires using the cell described above. Attempts were made initially to fix the pressure and measure the pressure emf as a function of temperature interval between the seals. This method proved to be difficult since the pressure and pressure distribution could not be maintained at a constant value due to thermal expansion of the cell upon heating and a subsequent redistribution of friction forces within the cell. All data reported here was therefore taken as induced emf vs. pressure at constant temperature intervals between the hot and cold seal. The agreement between the two sets of data was satisfactory, however.

The pressure on the axis of the cell undergoes an unusual cycle due to the presence of the highly incompressible tungsten carbide column that makes up the high-temperature seal. As the piston advances, the pressure at the top of this column increases rapidly, compared with the pressure in the rest of the cell. This continues until the pressure medium cannot support the stress gradient generated. Further piston advances increase the pressure uniformly throughout the cell. On the pressure release, the opposite effect occurs with the pressure decreasing rapidly at the top of the seal column. This pressure cycle will exhibit the opposite of the normal hysteresis cycle of a piston cylinder. Figure 8 shows the pressure emf for alumel at a fixed temperature interval between the seals as a function of the piston pressure. The reverse hysteresis effect is quite apparent.