

voltages are measured with a Leeds and Northrup K-3 potentiometer. The gradients can be made negligible by adjusting the heating currents to the three furnace windings. Around 400°C, the temperature could be controlled to within 1°C, and around 700°C to within 2°C.

The pressures are measured by a series of calibrated bourdon gauges¹⁵ and an additional set of strain gauges.¹⁶ Both sets of pressure gauges are recalibrated by a dead weight piston gauge.¹⁷ It is thus estimated that pressure measurements between 100 and 4000 bars can be made which are accurate to well within 1%.

Conductance cell and pressure gauges are connected to a system of 316 stainless steel capillary tubes (0.020 in. i. d.) and midget stainless steel valves.¹⁸ The pressure is controlled by hand operated, single piston, pressure generators.¹⁸ The conductance cell assembly and furnace, positioned vertically, are surrounded by a 15-in.-diam, cylindrical safety shield, constructed from steel plating of 0.37 in. thickness, which is hinged at each side and opens at the front. The furnace is suspended by means of pulleys and a counter weight which allows it to be positioned easily. A relay switch on the coolant water tap automatically cuts off the electrical power to the furnace if the water stops flowing.

OPERATION

The conductance was measured with an inductance bridge¹⁹ giving data with a precision of $\pm 0.1\%$. The frequency was varied by using an af signal generator and waveform analyzer.²⁰ The cell constant was determined with a 0.010 molal KCl solution at room temperature at various pressures. Measurements, with frequent changes of conductance water, were made over the whole temperature and pressure range to insure that the "background" conductance under all conditions was low when compared with the conductance of the subsequent solutions.

¹⁵ Heise Bourdon Tube Company, Newtown, Connecticut.

¹⁶ Baldwin-Lima-Hamilton Company, Waltham, Massachusetts.

¹⁷ W. C. 'T Hart & ZN, Rotterdam, Netherlands.

¹⁸ High Pressure Equipment Company, Erie, Pennsylvania.

¹⁹ Wayne-Kerr Corporation, Philadelphia, Pennsylvania, universal bridge type B-221.

²⁰ Wayne-Kerr Corporation, audio oscillator type S-121 and waveform analyzer type A-321.

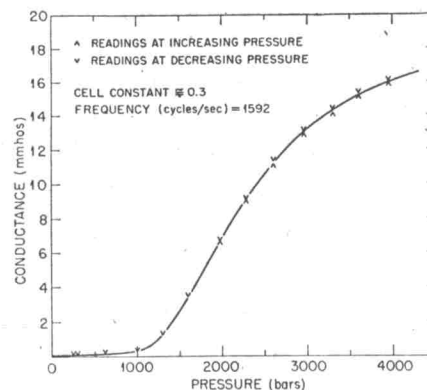


FIG. 2. Conductances of a 0.010 molal solution of KCl in H₂O at 800°C and up to 4000 bars.

Measurements were made either after filling the cell with a syringe before closure or by pressing the solution with the pressure generator into the cell after it had been evacuated. As soon as the desired temperature was attained, the pressure was decreased and increased stepwise; conductance measurements were made after each step. Figure 2 gives an example of a complete run using a 0.010 molal KCl solution at 800°C and at pressures up to 4000 bars. The symbols Δ and ∇ show the reproducibility of values upon increasing and decreasing the pressure of the fluid. An investigation of supercritical aqueous solutions of H₂SO₄ and metal sulfates is in progress; the results will be published elsewhere.

ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance of Father H. R. Jolley, S. J., Loyola University, New Orleans, and M. J. Kelly, Oak Ridge National Laboratory, in the preliminary experimental investigations with the conductivity cell. The enthusiastic assistance of the Oak Ridge National Laboratory Research Shops under the directions of C. R. Rickard and B. Cook in constructing the conductance cell and accessories is acknowledged. One of us (E. U. Franck) wishes to acknowledge the assistance of Oak Ridge National Laboratory in sponsoring his eight months stay at Oak Ridge (March–October 1960) during which time this work was completed.