Thermal Conductivity of Normal Hydrogen at Temperatures from 300 K to 700 K with Pressures Up to 70 MPa

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The thermal conductivity of normal hydrogen was measured with a transient hot-wire apparatus over the temperature range from 300 K to 700 K with pressures up to 70 MPa. The purity of the hydrogen sample was 0.99999 mole fraction as verified by chemical analysis at NIST. The measurement cell had 2 wires of different length to eliminate errors due to axial conduction and was located in a furnace that maintained its temperature. The hot-wire cell had a volume of about 50 cc and was pressurized with a diaphragm compressor. Hydrogen has a relatively large thermal diffusivity at pressures below 1 MPa so the transient heat pulse diffuses rapidly (less than 1 s) from the wires through the hydrogen to the outer boundary of the fluid, located at a radius of 4 mm. Steady-state measurements of the thermal conductivity with the same hot-wire cell are a good option at such conditions. Results for both transient and steady-state measurements of the thermal conductivity are reported for the dilute vapor. Only transient results are reported at higher pressures where fluid convection becomes significant during steady-state measurements. The thermal conductivity data have an expanded uncertainty (coverage factor k=2) of less than 1 % at elevated pressures where the influence of the outer boundary is not significant, increasing to 2-3 % at pressures below 1 MPa.