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SIMULTANEOUS VISCOSITY-DENSITY MEASUREMENTS OF GASES OVER A WIDE RANGE OF TEMPERATURE AND PRESSURE USING A VIBRATING-WIRE VISCOMETER AND A SINGLE-SINKER DENSIMETER

Abstract

Accurate simultaneous viscosity and density measurements were carried out using a newly designed apparatus for measurements on gases consisting of a vibrating-wire viscometer and a single-sinker densimeter. Precise density values measured directly are needed for high-precision viscosity measurements. The vibrating-wire viscometer was used as relative instrument which was calibrated by determining the wire radius with a theoretically based value for the viscosity of helium in the limit of zero density. Thus the viscosity measurements are characterized by a relative uncertainty of (0.25 to 0.3)%, whereas the relative uncertainty in the density is estimated to be less than 0.1%, except for the low-density range. This paper report on three isothermal series of measurements on helium at 293.15 K which were carried out to