The Measurement of Argon Viscosities by the Two-Capillary Viscometry from 200 K to 650 K

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Argon is the monoatomic gas that plays an important role in the primary acoustic thermometry because of its proper properties and specific isotopes. The viscosity of argon at variant temperature is the key parameter for the state-of-the-art primary acoustic thermometers. The accurate viscosity values of argon are especially important for primary acoustic thermometers working at high temperatures. The uncertainty less than 0.1 % for the viscosity values is requested. Currently, the two-capillary thermometry demonstrates the relative standard uncertainty less than 0.04 % of the measurements of argon viscosities from 200 K to 400 K. The measurements by the oscillating – disk viscometers have yielded the data at temperatures from 290 K to 680 K with the uncertainty from 0.1 % to 0.2 %. On the other hand, the *ab initio* calculations have yielded the data of argon viscosity in the wide temperature span from 1 K to 10000 K. The comparison has demonstrated the good agreement of the relative differences within 0.1 % among those experimental and the ab initio calculations in the overlapping temperature ranges. In this report, we present the new measurements of argon viscosities at temperatures from 200 K to 653 K by the authors upon the two-capillary viscometry. The relative standard uncertainty of the measurements is estimated to be 0.062 %. Besides the measurement results, we will discuss the observations with the two-capillary viscometer and the uncertainty sources with the measurements.