

PVT Measurements of Ammonia and Its Aqueous Mixtures in the Temperature Range from 350 K to 600 K at Pressures Up to 200 MPa

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Recently ammonia and ammonia-water mixtures have been given much attention to the usage as natural refrigerant and working fluid in new power cycles. It is desirable that more information on their thermodynamic properties particularly in high temperature and pressure region should be reported. We are measuring PVT properties of ammonia and its aqueous mixtures in the temperature range from 350 K to 600 K at pressures up to 200 MPa.

The basic method of measurements is the variable volume method using a metal-bellows. Isothermal air bath has been developed to achieve high accurate thermal control in the wide temperature range to 800 K. The pressure vessel in a block of stainless steel is located at the center of the isothermal air bath. Two-stage controlling system is adopted. The temperature of the air in the bath is controlled with a fluctuation of ± 10 mK at 323 K, ± 50 mK at 573 K and ± 50 mK at 800 K. The temperature in the bellows shows smaller fluctuation than that of the air temperature, i.e., ± 0.1 mK at 323 K, ± 5 mK at 573 K, and ± 5 mK at 800 K. The experimental uncertainties of temperature, pressure, density, and mole fraction are estimated to be less than ± 10 mK, $\pm 0.2\%$, $\pm 0.4\%$, and $\pm 0.15\%$ at a 95% confidence level, respectively. The saturated vapor pressure of ammonia at 350 K was measured and shows good agreement with the reference data [1, 2]. The results will be presented at the Conference.

[1] K. Kasahara, T. Munakata, and M. Uematsu, *J. Chem. Thermodyn.* **31**, 1273-1281 (1999).

[2] M. Sato, G. Masui, and M. Uematsu, *J. Chem. Thermodyn.* **37**, 931-934 (2005).