Second and Third Virial Coefficients of R32 and R125 Based on Gaseous PVT Measurements near Saturation

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For reliable derivation of thermodynamic properties in the gaseous phase from thermodynamic equations of state, our group has continuously pointed out that the third virial coefficient has an important influence on the thermodynamic properties near saturation. However, correct quantitative third virial coefficients are not available. Our group has already confirmed that the determination of virial coefficients using the intermolecular-potential model is effective. For R143a, we confirmed that we were able to derive the common parameter values of the intermolecular potential model with a new temperature-correction parameter and the second and third virial coefficients from two independent different methods. One method is to determine the parameters based on sound-speed measurements in rarefied gases and the other is based on PVT measurements of gases near saturation. We determined the second and third virial coefficients based on precise PVT measurements of gases at near saturation with a magnetic suspension densitometer for R32 and R125. The virial equation having these second and third virial coefficients can reproduce reliable thermodynamic property measurements within the experimental uncertainty, and provide a reasonable thermodynamic surface for gaseous single phase states, including at or near saturation. The values of the third virial coefficient can be quantitatively confirmed by comparing with those determined from sound-speed measurements in rarefied gases. We will perform examinations from various viewpoints for our determination of second and third virial coefficients.