Argon Fundamental Asymmetric Equation of State

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In this paper the method of construction of the equation of state (EOS) which satisfies the requirements of the virial EOS and scaling EOS which account for the asymmetry relative to the critical isochore. The method is based on the Benedek hypothesis [1] and the phenomenological theory of critical phenomena [2, 3]. Standard deviation calculated by the EOS of this work and the experimental data was in a single-phase region: density 0.21%; pressure 0.39%; isochoric heat capacity including a wide neighborhood of the critical point 2.7; speed of sound 1.7%; isobaric heat capacity 0.9%.The proposed method is tested on the example of the construction of the argon asymmetric EOS. Calculated tables of equilibrium properties of argon in a wide range of state parameters: density from 0 to 3.35 critical density, temperature from the triple point to 1200 K. Also calculated detailed thermodynamic tables for critical and metastable parts of thermodynamic surface. It is shown that the accuracy of the description of the isochoric heat capacity in the critical region of suggested equation of state is significantly higher than crossover equation [4] and accuracy description of the density and sound speed in the metastable region corresponds to the experimental. Standard deviation calculated by the EOS of this work and the experimental data in the metastable region was: density 0.08%; speed of sound 1.2%.

References

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