Journal of Statistical Physics, Vol. 3, No. 1, 1971

On the Dependence of the Condensation Coefficient on Surface Curvature

A. G. Sutugin[1]

Received April 29, 1970; revised October 9, 1970

It is concluded that there is as yet no adequate theoretical solution for the size dependence of the condensation coefficient, the Okuyama–Zung approach to this problem being discounted.

KEY WORDS: Condensation coefficient; supersaturation; nucleation.

Several authors[1,2] have pointed out that the existence of the dependence of condensation coefficient α on cluster size may be important for the theory of homogeneous nucleation in supersaturated vapors. Okuyama and Zung[3] have obtained the relation between α and the radius of a growing droplet. They concluded that the α values for very small droplets must be several orders of magnitude lower than for a flat surface. These authors believed that the decrease of the α values with diminishing droplet size was due to work done in creating a new surface when molecules are added to a droplet. They expressed this work in terms of the Kelvin–Gibbs correction for the evaporation rate from a curved surface. For condensation onto a concave surface, the Okuyama–Zung theory predicts a value > 1, which is absurd. Moreover, their theory must have a logical consequence that the evaporation coefficient α_e for a convex surface is larger than for a plane one, and therefore for a convex surface we must have $\alpha_e > \alpha$, which is inconsistent with the detailed equilibrium principle.

Thus, the Okuyama–Zung approach to this problem is erroneous; there is as yet no adequate theoretical solution for the size dependence of the condensation coefficient.

[1] Karpov-Institute, Moscow, USSR.

REFERENCES

1. H. Frisch and L. Collins, *J. Chem. Phys.* **20**:1797 (1952).
2. J. Feder, K. Russel, J. Lothe, and G. Pound, *Advan. Phys.* **57**:111 (1966).
3. M. Okuyama and J. Zung, *J. Chem. Phys.* **46**:1580 (1967).