Interdiffusion: compatibility of Darken and Onsager formalism

Bogusław Bożek

Abstract

A unified treatment of interdiffusion in various reference frames is presented in view of the consistency between Nernst–Planck, Onsager and Darken formalisms. A present discussion involves (i) material, (ii) laboratory and (iii) Rth component reference frames. It is shown that when the fluxes and forces are linearly interrelated, one can define a symmetric matrix of phenomenological coefficients. Its explicit form is derived. Problem is generalised to the case of different molar volumes that satisfy Vegard law, which presents entirely new result. An evidence is given that the Onsager fluxes can be equivalently treated as the fluxes due to the material drift and diffusion, as accounted in Darken treatment. The entropy production is the same within both formalisms.

References

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