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THERMODYNAMIC INTERDIFFUSION COEFFICIENTS IN TERNARY SYSTEMS

G.B. Kale[1], K. Bhanumurthy[1], A. Laik[1] and S.P. Garg[2]
[1]Materials Science Division, [2]Human Resource Development Division,
Bhabha Atomic Research Centre, Mumbai. 400 085, INDIA
E-mail : gbkale@apsara.barc.ernet.in

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ABSTRACT

A new form of diffusion coefficient, termed as thermodynamic diffusion coefficient for ternary diffusion analysis using the true driving force of chemical potential gradient has been presented. These thermodynamic diffusion coefficients are better estimates of the diffusivities as true driving force for diffusion has been used. The analysis has been applied to ternary diffusion in Fe-Ni-Cr alloy system. The four thermodynamic interdiffusion coefficients $\tilde{D}^{Fe}_{NiNi(\mu)}$, $\tilde{D}^{Fe}_{NiCr(\mu)}$, $\tilde{D}^{Fe}_{CrNi(\mu)}$ and $\tilde{D}^{Fe}_{CrCr(\mu)}$ have been evaluated employing Boltzmann - Matano solution. The composition dependence of these thermodynamic interdiffusion coefficients can be expressed by a relation of the type $\log \tilde{D}_{(\mu)} = b_1 + b_2 N_{Ni} + b_3 N_{Cr}$. The thermodynamic interdiffusion coefficients for ternary system have been related to the thermodynamic intrinsic diffusion coefficients by extending Darken's analysis for binary system to ternary system. The thermodynamic intrinsic diffusivities are equal to the tracer diffusivity values in ternary alloys. The analysis can be used to estimate tracer diffusivity in alloys without using radioactive tracers.

Keywords: thermodynamic diffusion coefficients; Fe-Ni-Cr alloy system; interaction parameters