Massachusetts Institute of Technology
Kinetic Processes in Materials

3.21 Spring 2002

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Problem Set 2: Due Mon. Feb. 25, Before 5PM in 4-049

Exercise 2.1

Please solve Excercise 3.4 in *KPIM.*

Exercise 2.2

Please solve Excercise 3.7 in *KPIM.*

Exercise 2.3

Please solve Excercise 4.5 in *KPIM.*

Exercise 2.4

Please solve Excercise 4.6 in *KPIM.*

Exercise 2.5

This is a question that can many different forms of solution and variable degress of completeness. Such questions may require that you and your homework group make and justify physical assumptions, or some type of simulation, or data extraction.

As an aid, some of the data for this problem can be found in http://pruffle.mit.edu/c̃carter/3.21/DATA/

The attached figures show measured diffusion data for Au-Ni alloys, including intrinsic diffusivities D^*_{Au} and D^*_{Ni}, and the interdiffusivity $\tilde{D}_{\mathrm{Au\text{-}Ni}}$. In addition, data for the "thermodynamic factor" in diffusion theory are provided on a separate plot.

Use the data provided to evaluate the validity of the Darken equation for diffusion in Au-Ni alloys at 900°C.

Discuss whether the data can be fit by Arrhenius form and if so determine the activation energy.

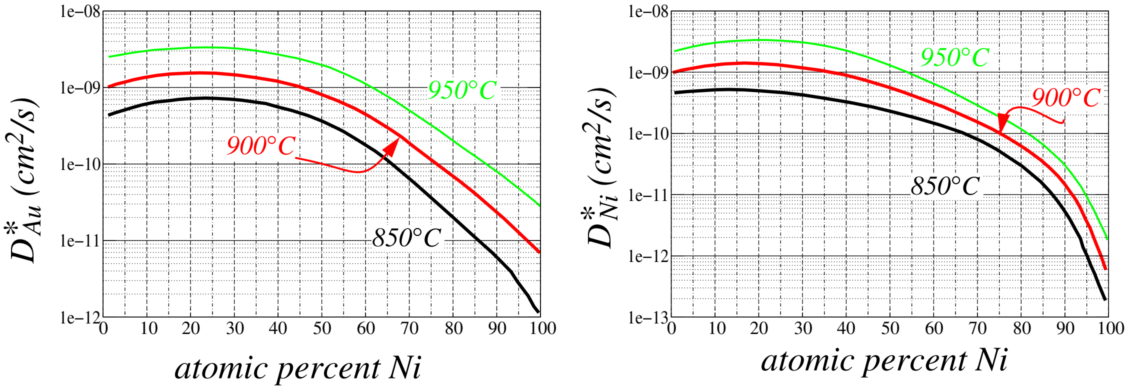

Figure 2-5-i: Measured self-diffusion coefficients for gold and nickel as a function of alloy composition.

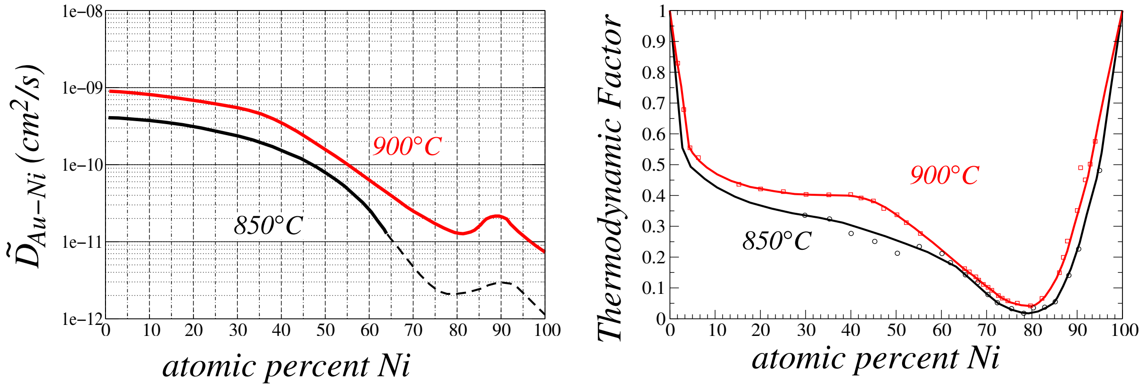

Figure 2-5-ii: Measured interdiffusion coefficient and thermodynamic factor in Au-Ni alloy.