Problem set 4

CME 570: Diffusion Phenomena in Materials

Instructor: Sara Kadkhodaei

Due Date: November 13, 2019 until midnight

Prepare a report after running the simulation of your specific system using DICTRA:

- Determine the phase of the binary couple (e.g., both sides are bcc or fcc) and the composition difference between the couple. You should be able to determine the phase and composition range based on the phase diagram of the system. Plot the phase diagram and show that in your report. Also show the phase and composition range in the phase diagram.

- Assume that these two materials are joined together in a weldment and then kept at an elevated temperature for a period of time. Assume that the length of each side is 0.5 mm. Plot the following:

  1. concentration profile
  2. flux of each species
  3. activity profile
  4. chemical diffusion profile

  You should be able to determine the simulation temperature based on the phase diagram.

- Having the concentration profile for a specific annealing time, use the Mattano-Boltzmann relation to reproduce the chemical diffusivity for different concentration. Compare that with the results of your simulation.

- Examine Darken's equation based in the calculated tracer diffusivity, thermodynamic factor, and chemical diffusivity.