

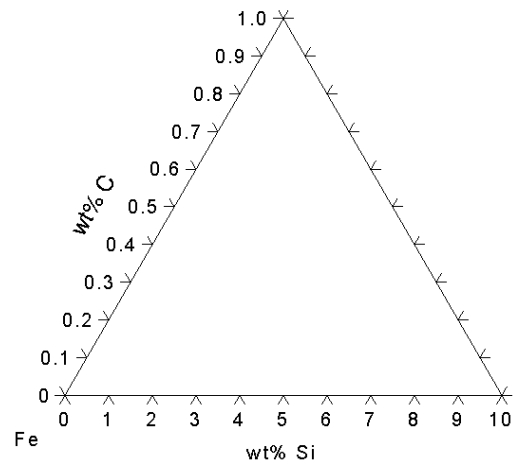
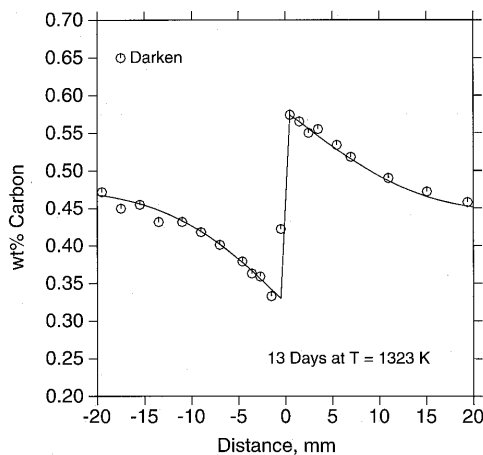
AMSE502 Phase Transformations

due Date: Apr. 18, 2023

Problem Set #3

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1. Plot the diffusion path for the Darken's uphill diffusion (left) on the isothermal section (right) and explain it.
How would the carbon profile and diffusion path change if the time passed more so that the Si concentration shows a non-zero gradient within 10mm across the interface? Plot the diffusion profile (left) and diffusion path (right) in comparison with those for the 13Days annealing time.



2. Consider injection of an alloying element B in a metallic matrix A. The initial composition of B in A is 0.01. Injection is carried out by maintaining the surface composition of B to be 0.05. The diffusion coefficient of B in A is $4.529 \times 10^{-7} \exp[-147723(\text{J})/RT]$ (m^2/s). The injection temperature is between 1173K and 1473K. Injection distance is defined to be the distance from the surface of a point where the composition of B is half of the target value (0.03). Using the diffusion simulation code (FDM.for), perform the followings:
- (a) How does the injection distance depend on injection time?
 - (b) How does the injection distance depend on temperature?
 - (c) How can you determine the activation energy for the reaction, and what is it?