Notes on IMCs growth.

I have spend some time thinking about your question on problem statement for intermetallics (IMCs) kinetics.

I am new in area of diffusion and I would highly appreciate some advices according to that subject.

I’ll let my self remind you the topic of our discussion.

In this model I consider diffusion controlled growth of IMCs. In general, the driving force for diffusion is a gradient of chemical potential, but for some simplified cases it can be replaced by concentration gradient.

We consider diffusion in each layer described by 2nd Fick’s law.

At the interfaces, if the rate of chemical reaction is much faster than diffusion, we have a chemical equilibrium, which means equality of chemical potentials and some fixed concentrations at the interfaces.

The driving force for interface evolution is summarized from left and right fluxes at the interfaces.

As a 1st approximation we can suggest that concentration is linear in every IMC layer and thus the flux can be simply computed as a finite difference from prescribed concentration values at the interfaces.

However, as you noticed, if we have a constant initial concentration profile, than there will be no flux, and our interfaces will not move with time. This seems like a contradiction, but as I understand it, in that case the following will happen.

At the beginning we have constant initial profile. That means there will occur some diffusion as usual. For that diffusion there will be no chemical equilibrium at the interfaces, our sharp interface will be smoothed. That is true only at the beginning of the process. As some of the tin will penetrate through all the IMCs and reach copper, the chemical reaction will occur and after some time (if the rate is much faster then diffusion) the system will reach local chemical equilibrium.

So, summarizing, in case of constant initial profile, boundary conditions for chemical equilibrium should be omitted.

About approximation of the flux.

Types of approximation: Inititial distribution?

Notes:

1. Rough surface is longer -> more surface for diffusion -> flux is bigger. We can introduce some correction factor.