Diffusion Simulation Software

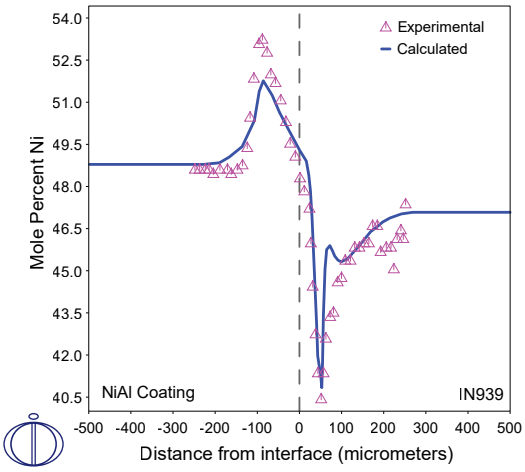
Diffusion Module (DICTRA)

The Diffusion Module (DICTRA) is an Add-on Module to Thermo-Calc that makes modeling multicomponent diffusion-controlled transformations simple and accessible. The Diffusion Module (DICTRA) is based on the numerical solution of the multicomponent diffusion equations and the CALPHAD approach.

Questions Diffusion Simulations Can Help You Answer

The Diffusion Module (DICTRA) is a general tool for making diffusion simulations, but some typical questions it can help you answer are:

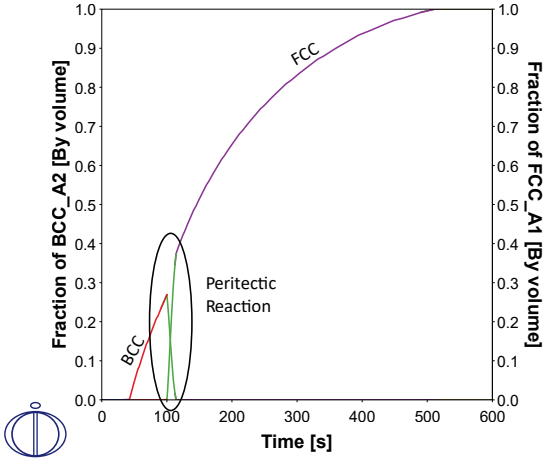
- How long of a holding time is required at a specific temperature to homogenize the as-cast microstructure?
- How long of an annealing time is needed to dissolve precipitates of a given size?
- How does the cooling or heating rate influence the amount of phases transformed?
- What elemental profiles result post welding or other similar joining operations?
- Will undesirable phases form when joining two dissimilar materials?



Interdiffusion between a NiAl coating on IN939 at 1050 °C after 96 hours, simulated using the Diffusion Module (DICTRA). The calculation is compared to experimental data from E. Perez, T. Patterson and Y. Sohn, J. Phase Equilibria and Diffusion 27 (2006), pp. 659-64.

The Diffusion Module (DICTRA) Allows You to Simulate:

- Microsegregation during solidification
- Homogenization of alloys
- Growth/dissolution of secondary phases, such as carbides, nitrides, or intermetallic phases
- Coarsening of precipitate phases
- Allotropic phase transformations, such as austenite to ferrite transformations in steel, or hcp (alpha-Ti) to bcc (beta-Ti) in titanium alloys
- Carburization, nitriding, and carbonitriding of high-temperature alloys and steels
- Interdiffusion in compounds, such as coating systems, dissimilar joints, and so on
- Post weld heat treatment (interdiffusion and related phase changes)
- Sintering of cemented-carbides



Fraction solid calculated for moving phase boundaries during solidification under full consideration of diffusion in all solid and liquid phases. The peritectic reaction takes about 10 seconds to complete for the chosen cooling rate.

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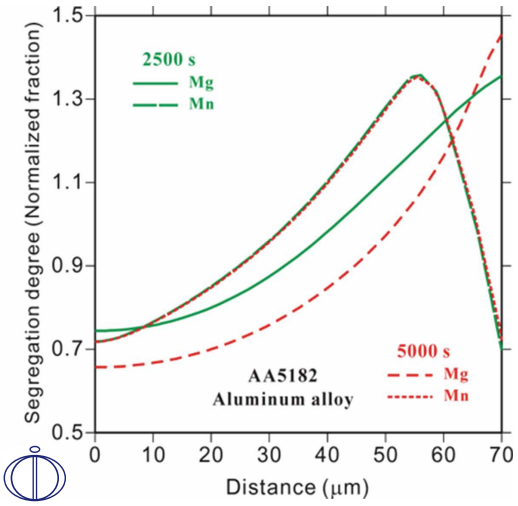
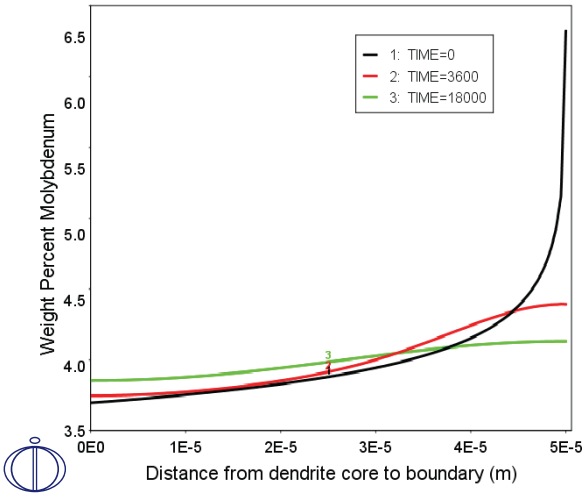
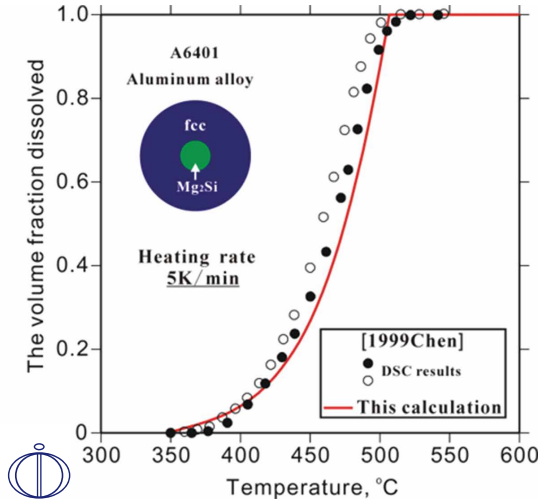


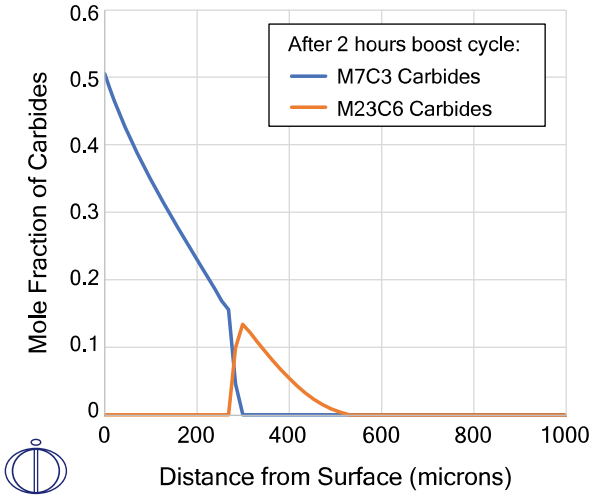
Microsegregation during solidification in Alloy AA5182



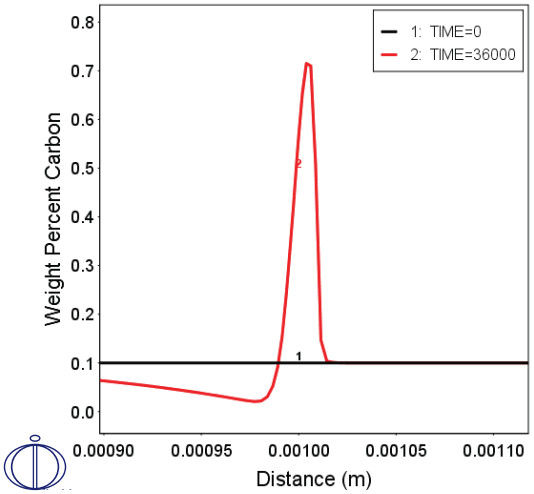
Homogenization of casting segregation in Ni Alloy 713



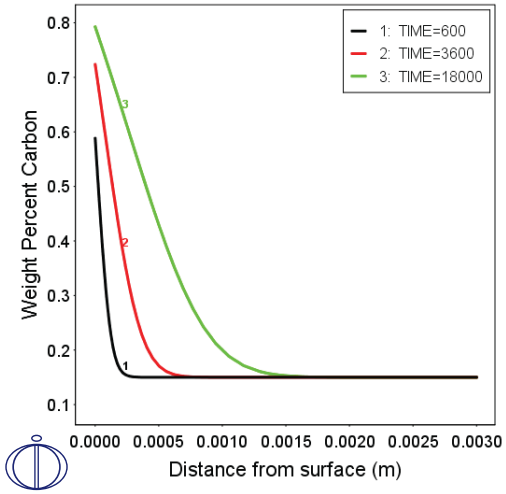
Dissolution of Mg2Si precipitate in Alloy A6401



Formation of precipitate carbides of a martensitic stainless steel



Carbon pileup at dissimilar metal weld interface during service



Carbon profiles during carburization of low alloy steel