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Effect of temperature and homogenization of low allouy steek by Dictra® simulation

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EFFECT OF TEMPERATURE AND HOMOGENIZATION TIME OF A LOW ALLOY STEEL BY DICTRA® SIMULATION

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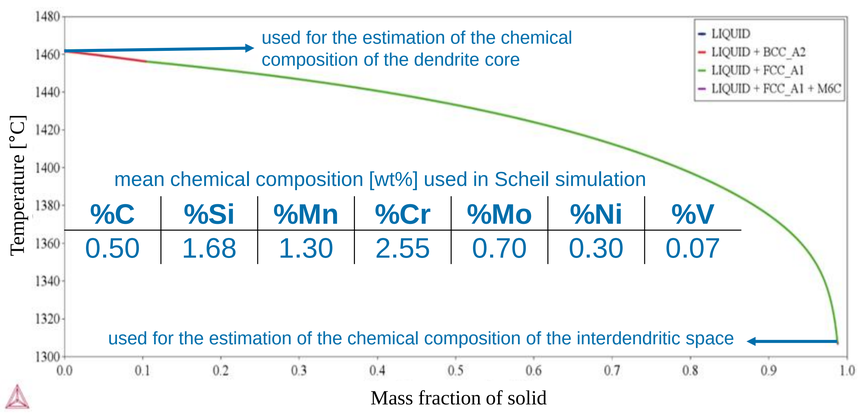
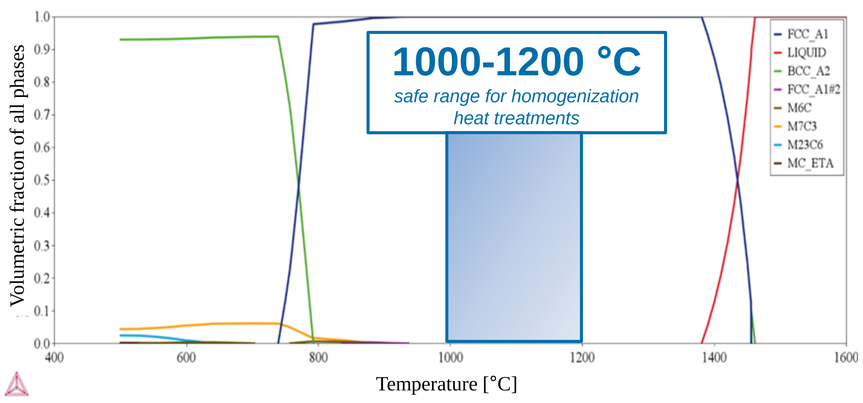
Is DICTRA® a powerful solution for evaluating homogenization heat treatments of as-cast low alloy steels?

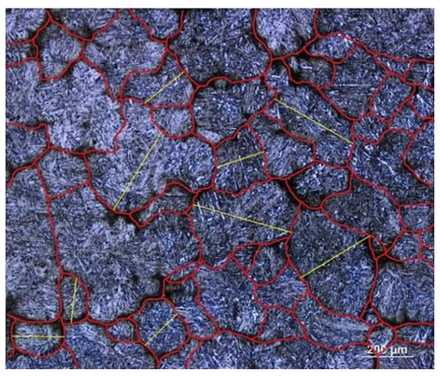


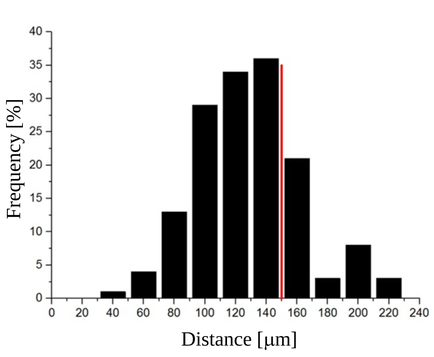
mean chemical composition [wt%] used in Scheil simulation

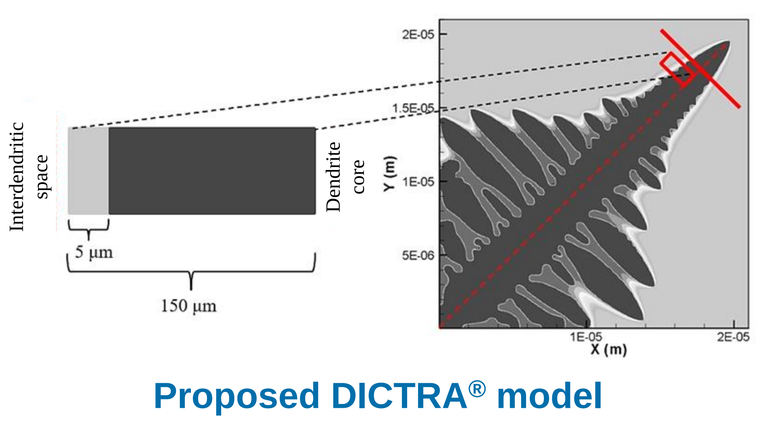
%C	%Si	%Mn	%Cr	%Mo	%Ni	%V
0.50	1.68	1.30	2.55	0.70	0.30	0.07

ThermoCalc®, TCFE9 database

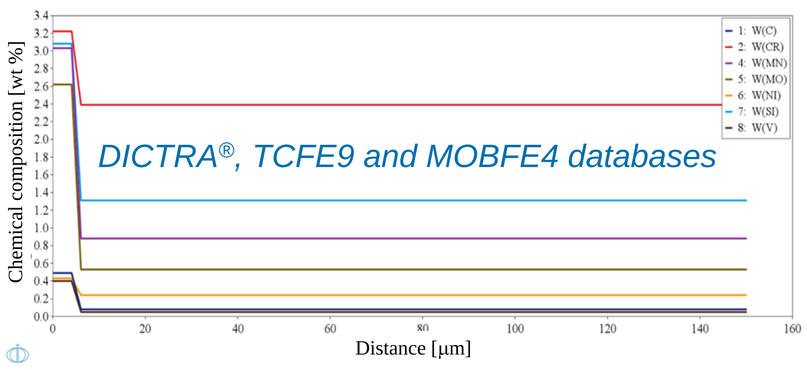




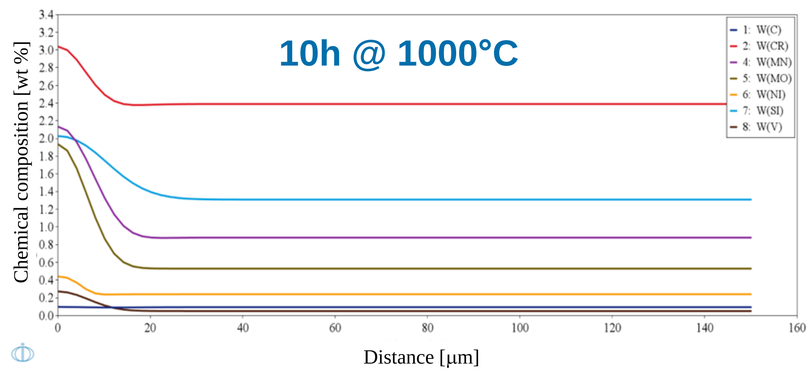


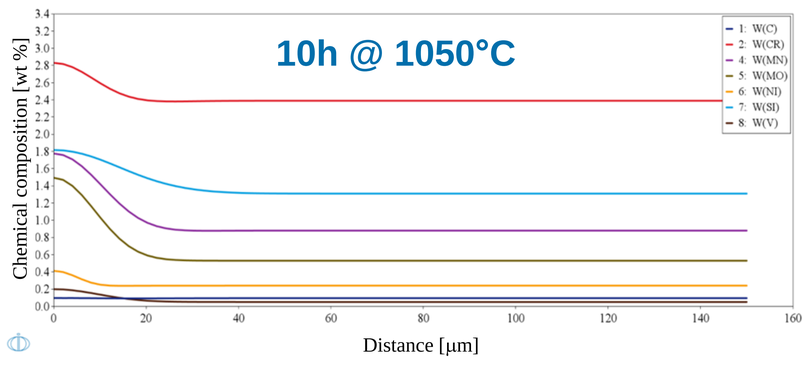


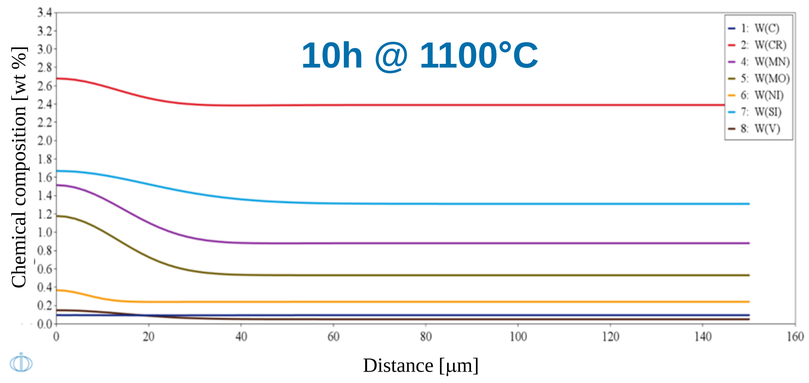
Proposed DICTRA® model

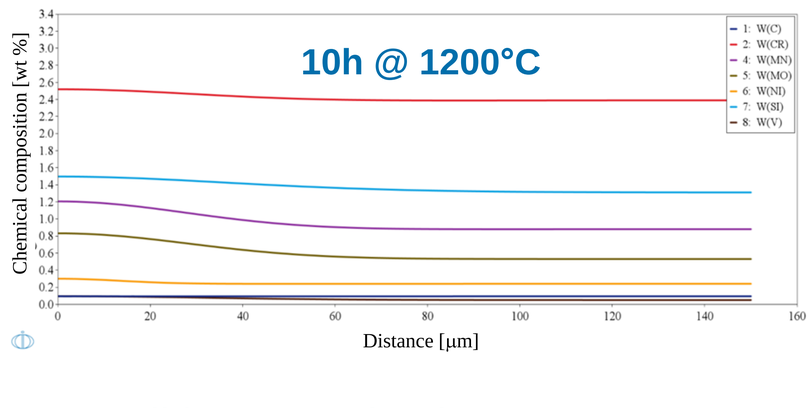


DICTRA®, TCFE9 and MOBFE4 databases

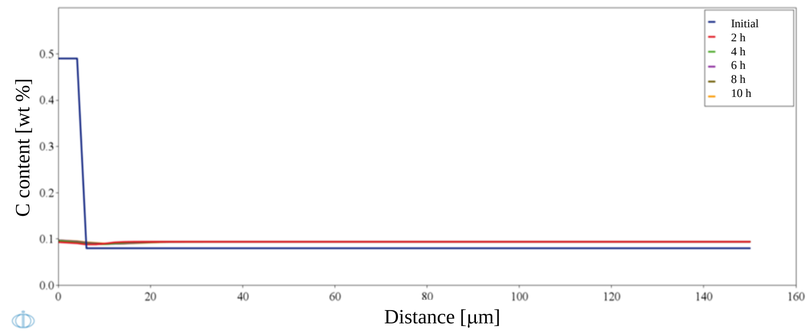




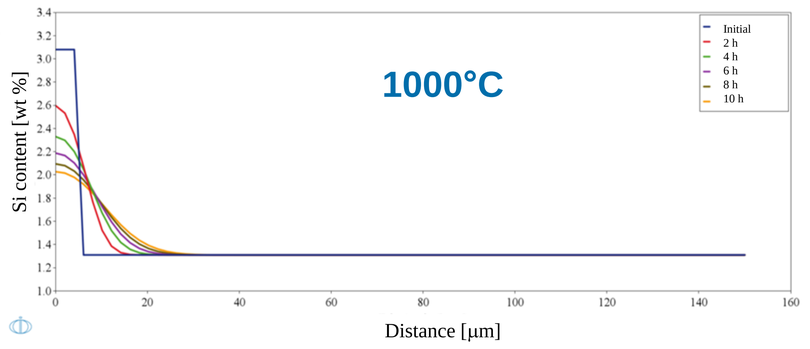




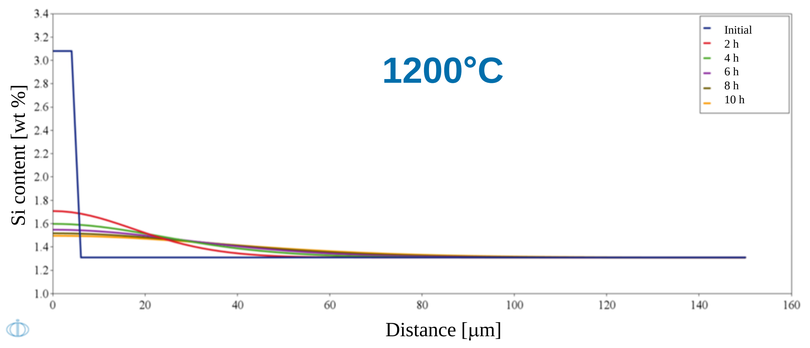
Full homogenization was not achieved even after 10 h at 1200°C



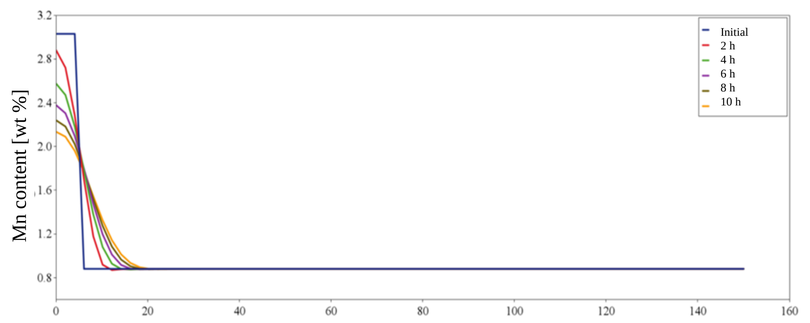
easy carbon homogenization, as expected



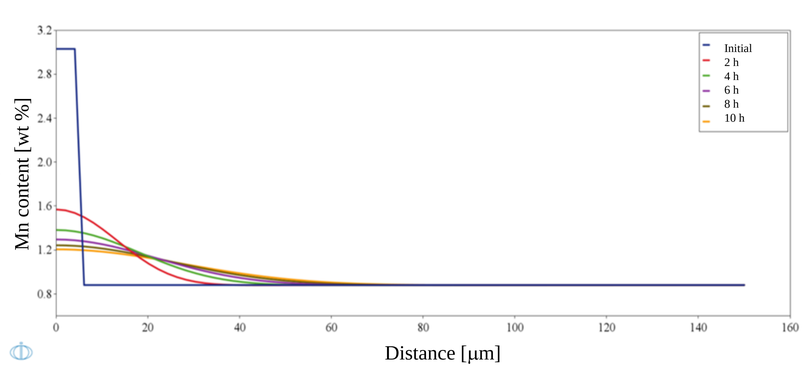
Discrete attenuation of Si gradients at 1000°C



Si gradients still exist even after 10 h at 1200°C



Severe Mn gradients even after 10 h at 1000°C



Mn gradients still exist even after 10 h at 1200°C

CONCLUSIONS

1. Increasing homogenization temperature and/or time reduces the chemical composition gradient between dendritic and interdendritic regions.
2. The elimination of the chemical composition gradient for C is fast, with 2 hours at 1000°C being sufficient, justified by the fact that this is an interstitial element to iron and, therefore, has greater mobility by diffusion in the crystal structure.
3. Even with the maximum simulated homogenization conditions, i.e., 10 hours at 1200°C, there is no complete elimination of gradients for substitutional alloying elements.
4. Dictra® simulation allows the evaluation of the efficiency of heat treatments for homogenization of raw melting steels.

Acknowledgments: to CAPES, EMBRAPII, IPT and FEI