The growth of acicular ferrite in Fe-Cr and Fe-Mn

Massive transformation in Fe-Mn

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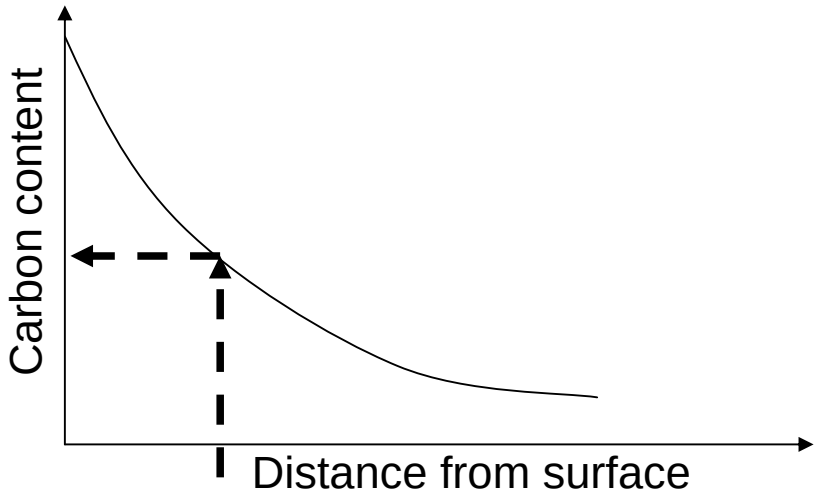
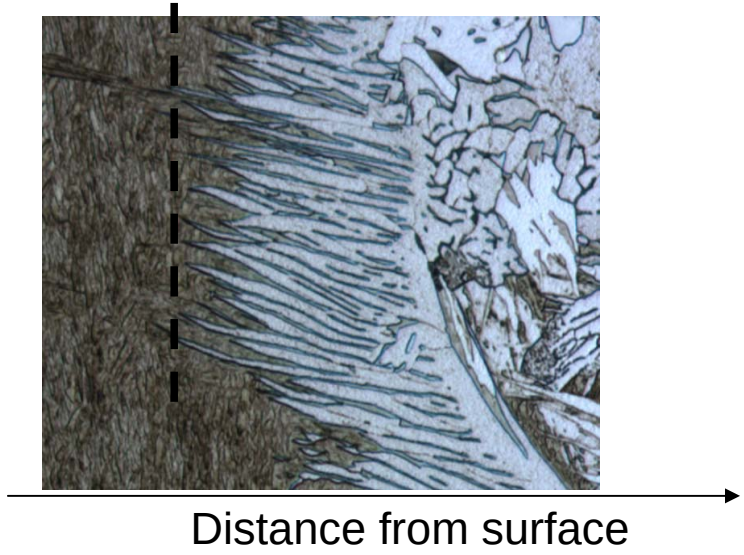
The gradient technique

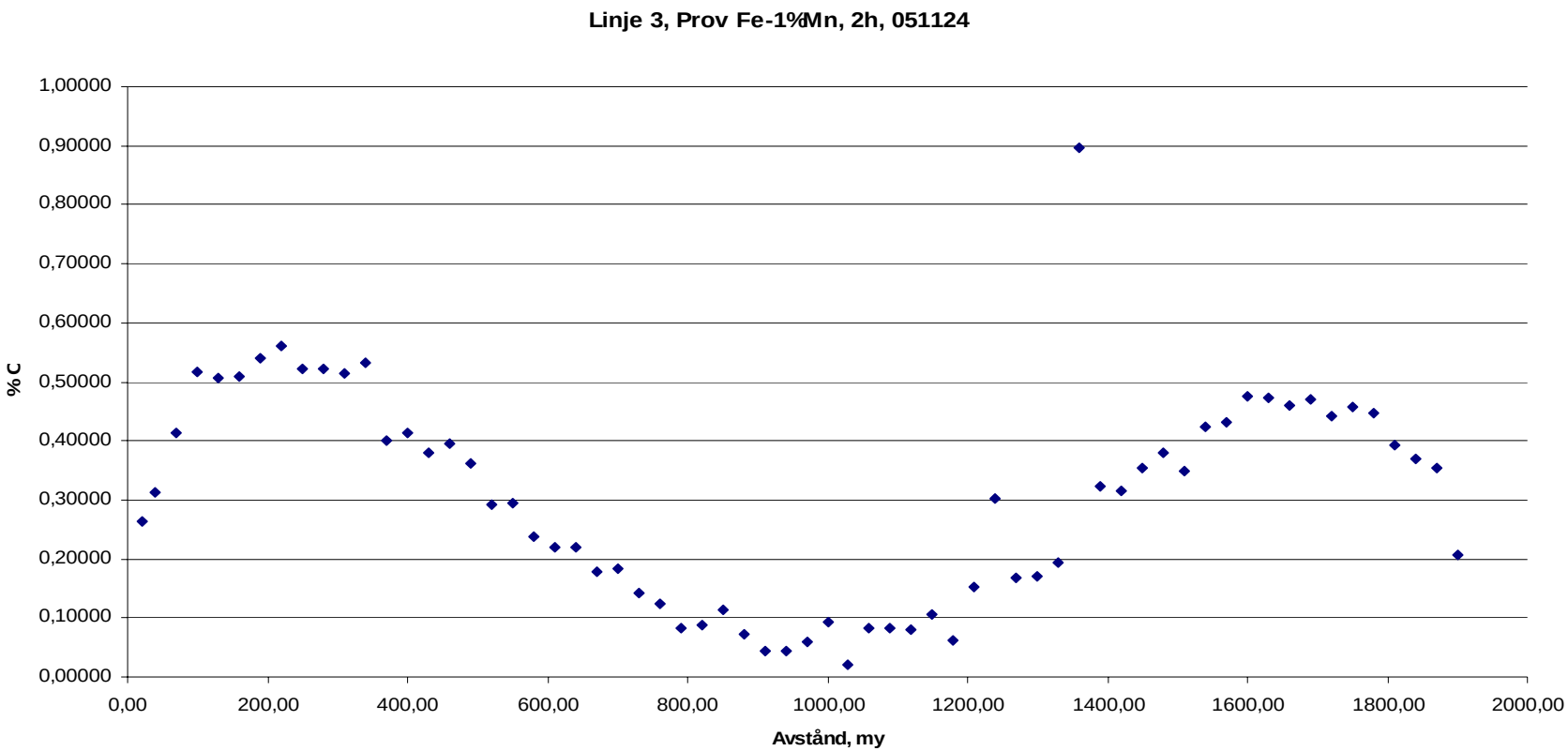




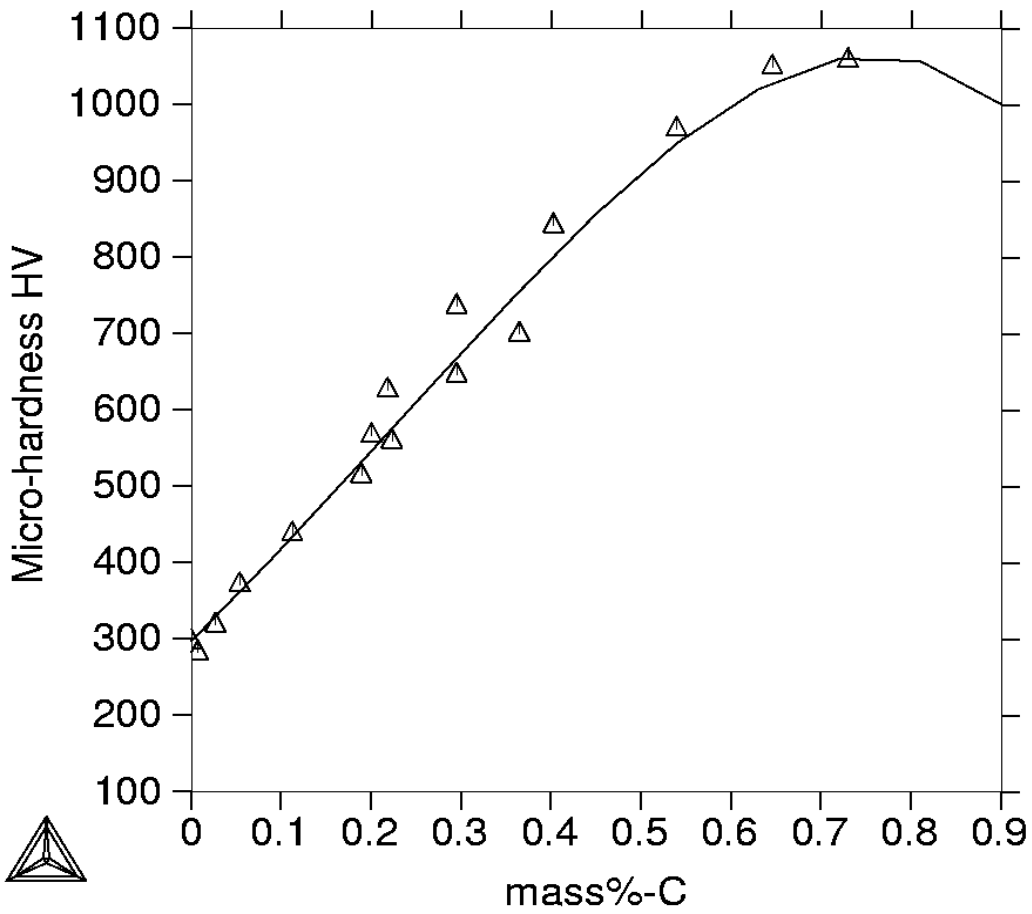
The growth of acicular ferrite: Experimental work

- Fe - 0.92, 1.81, 3.67, 5.54, 7.60 mass% Ni
- Fe – 0.99, 1.98, 3.92, 5.66 mass% Cr
- Fe – 0.71, 1.69, 2.60, 5.46 mass% Mn
- Carburized
- Isothermal heat treatment
- Microstructure studied by LOM
- Measurements of the composition gradients with ASEM

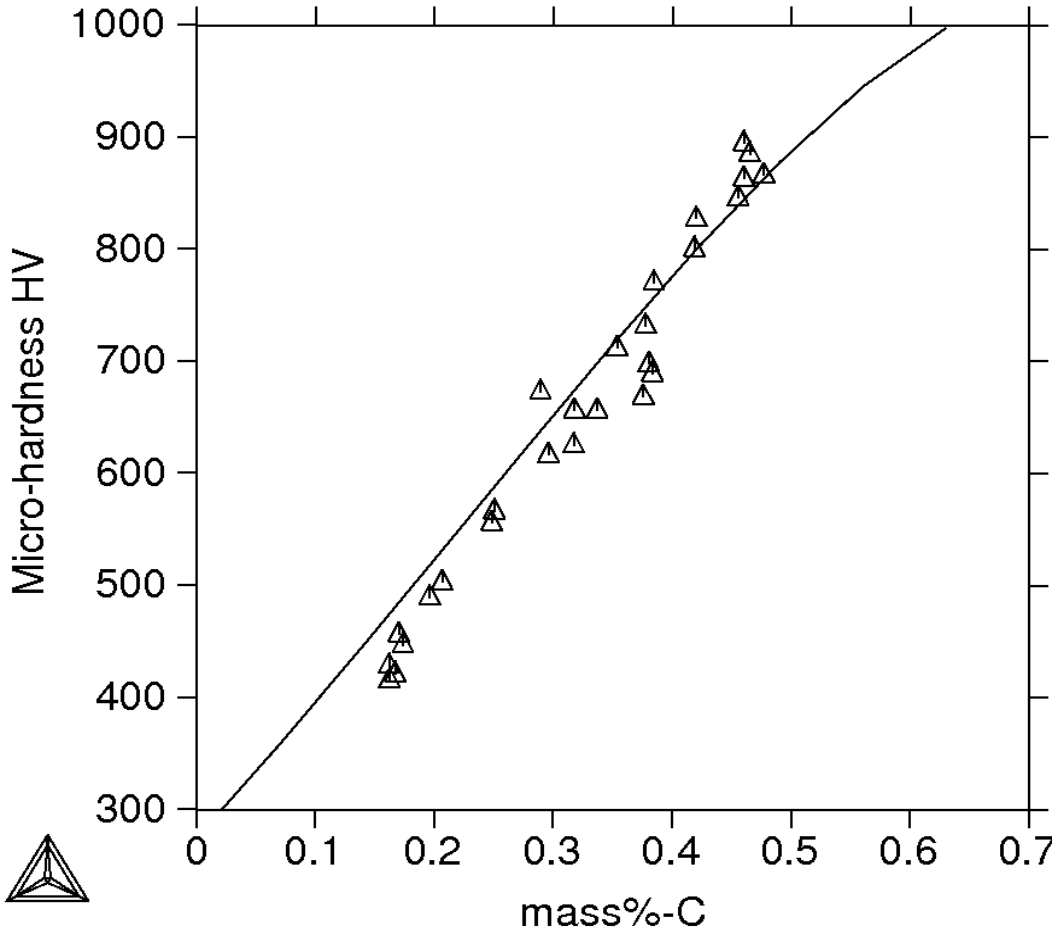
Measurement of the carbon gradient with ASEM



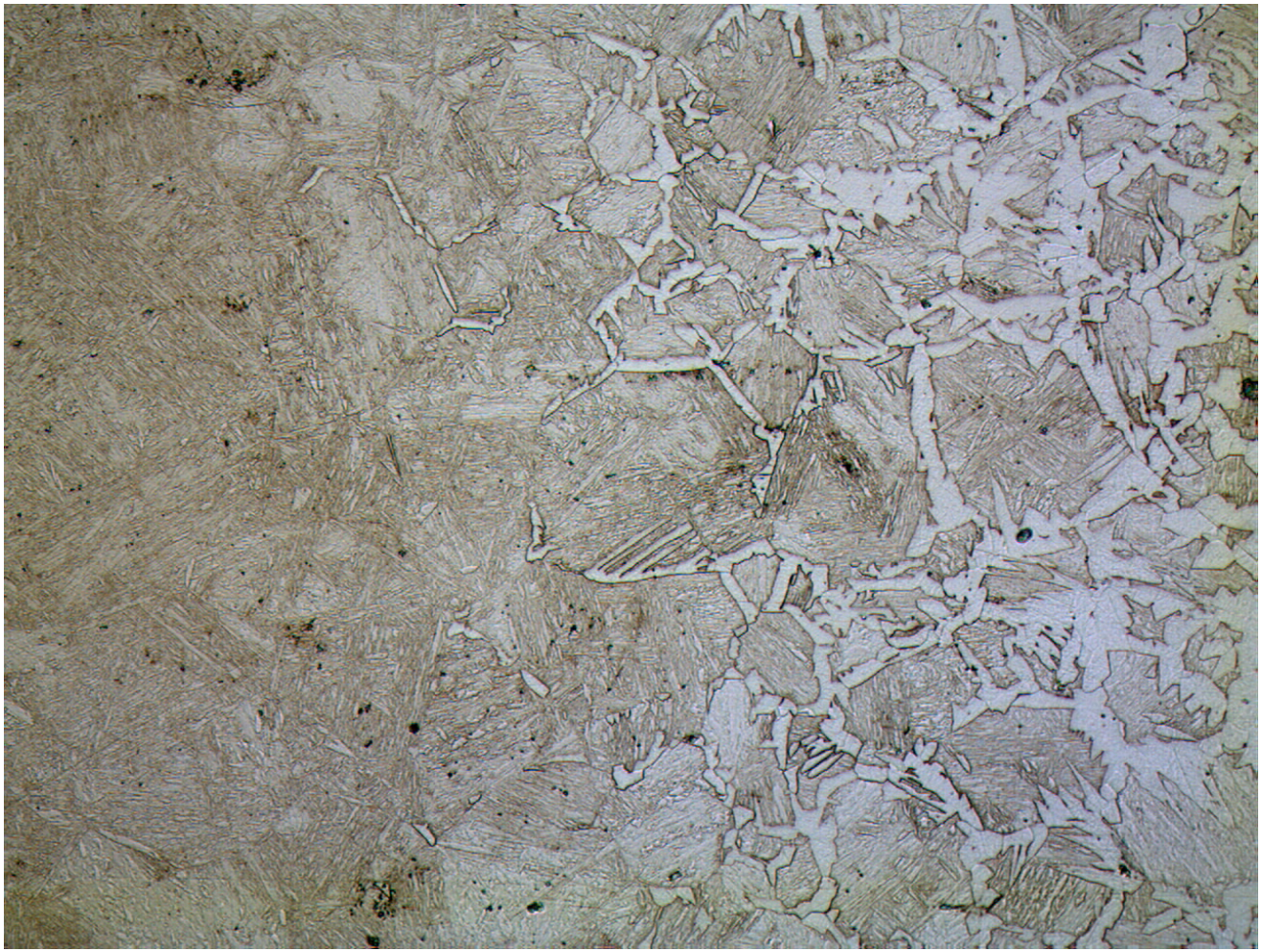
Correlation between micro-hardness and carbon content for 2% Mn



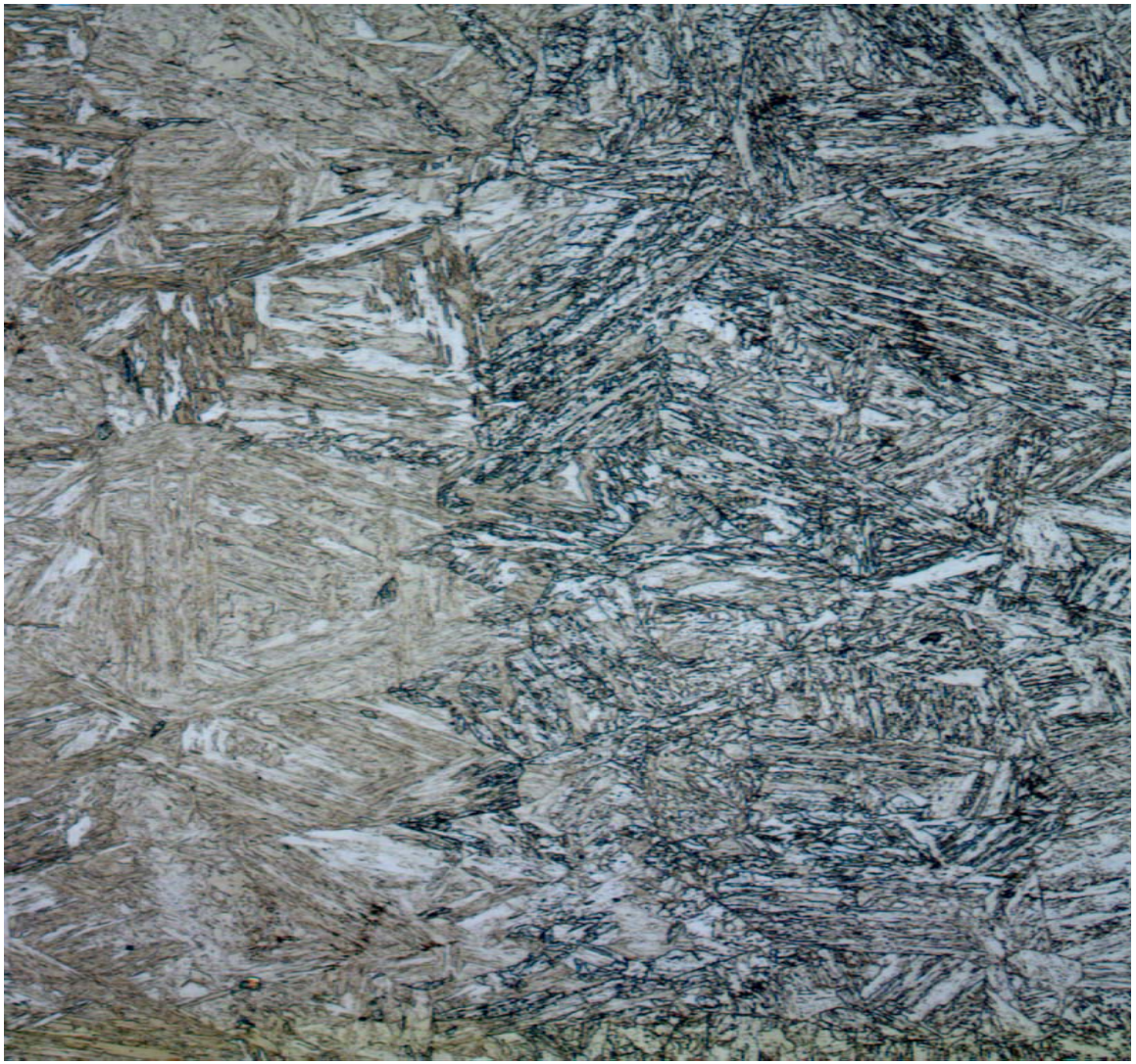
Correlation between micro-hardness and carbon content for 2% Cr



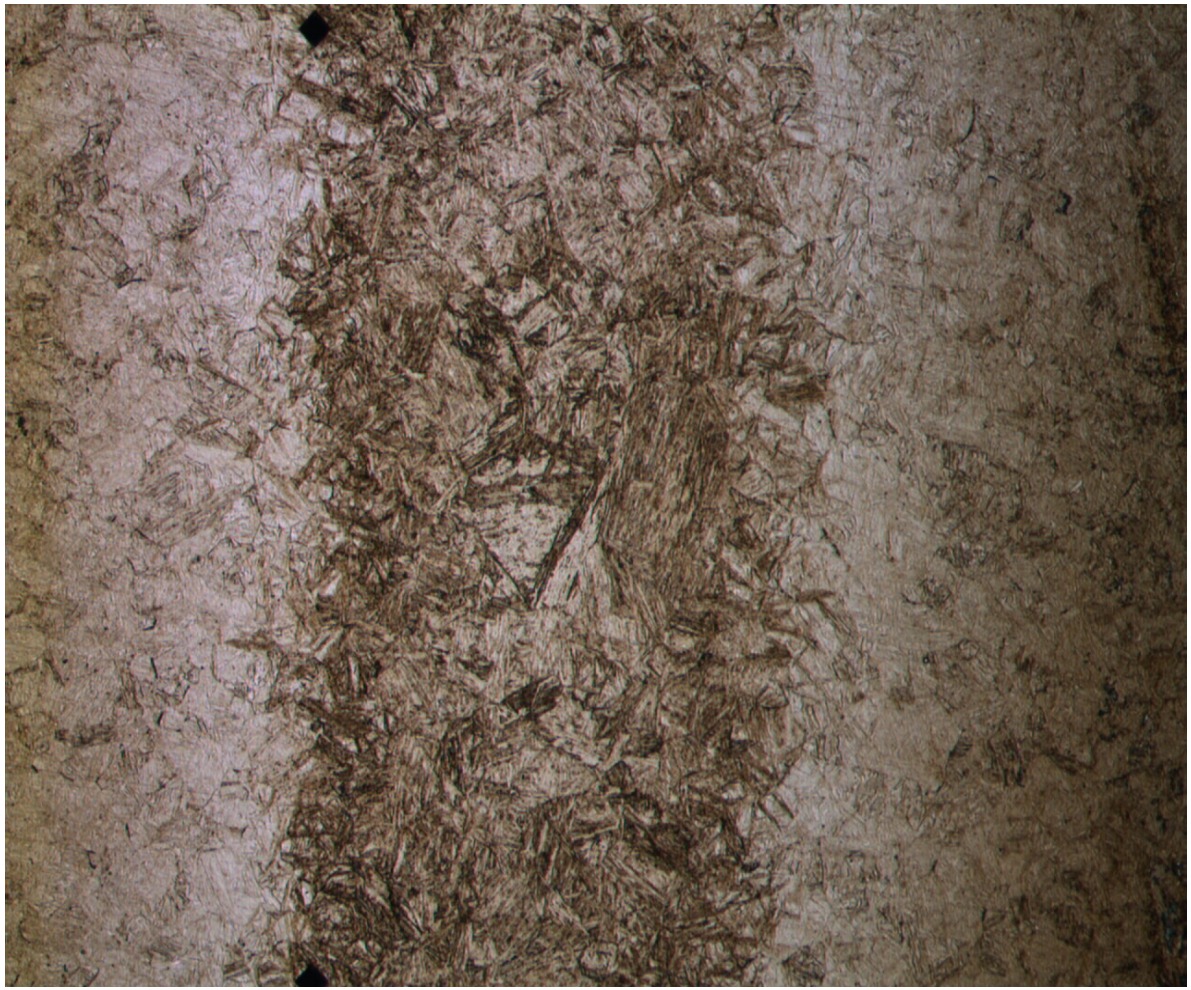
1%Mn 725°C



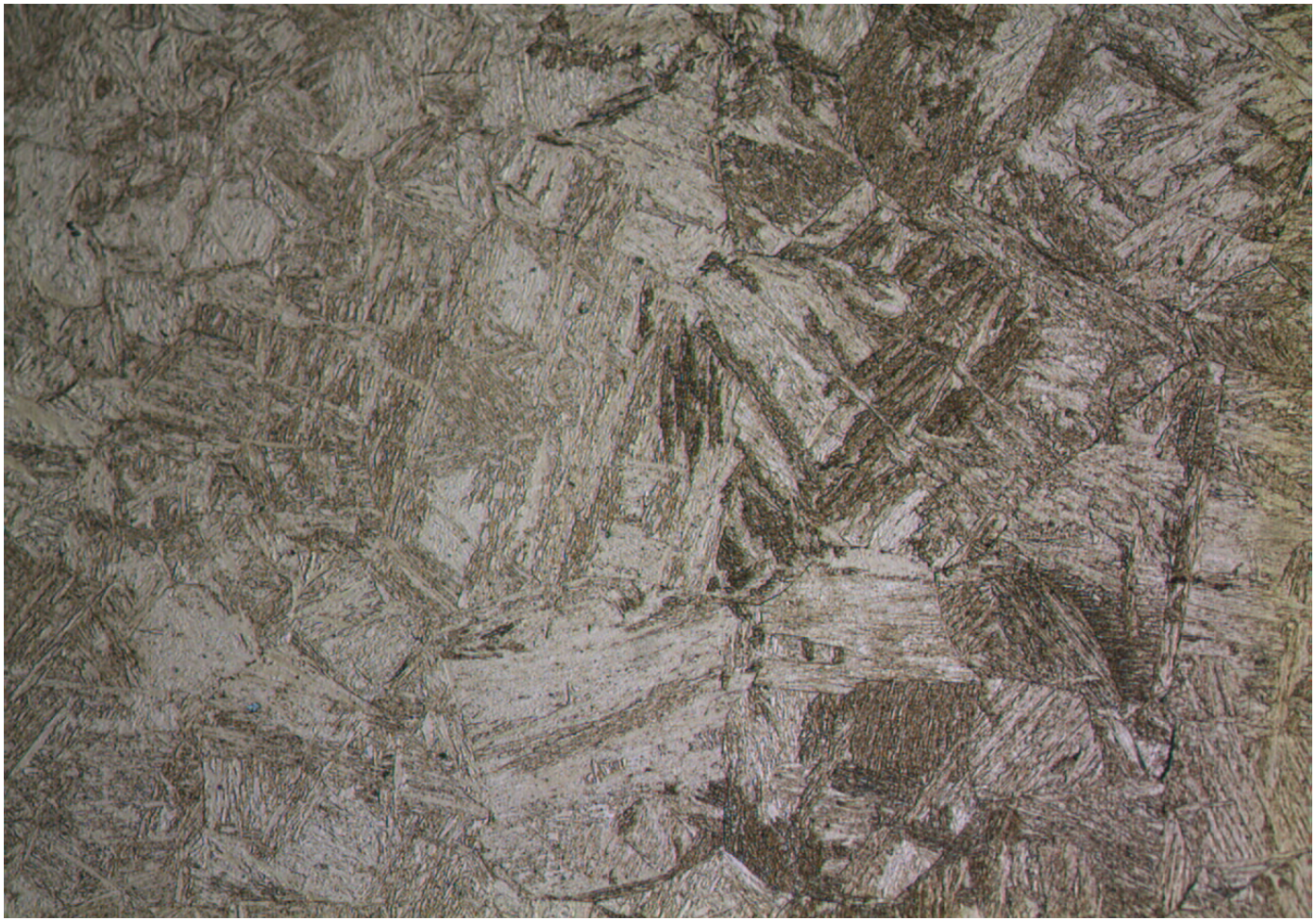
6% Mn 350°C



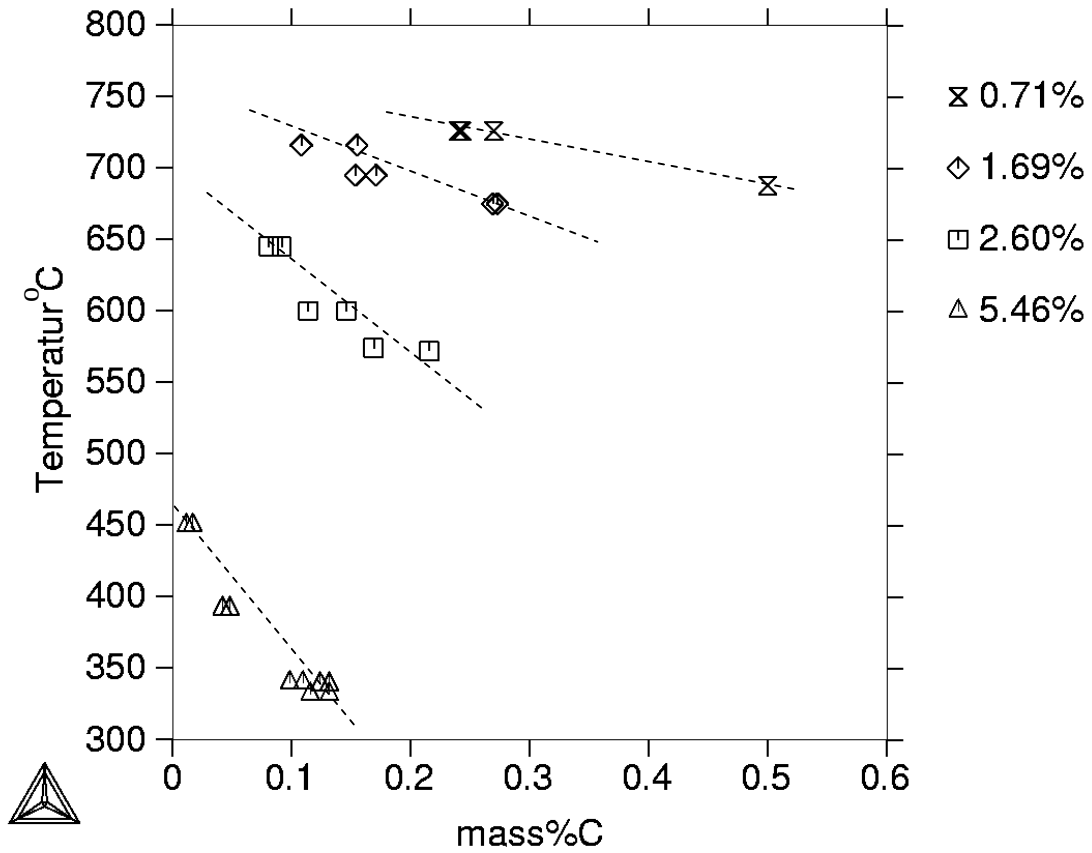
5.66 mass% Cr, 438°C



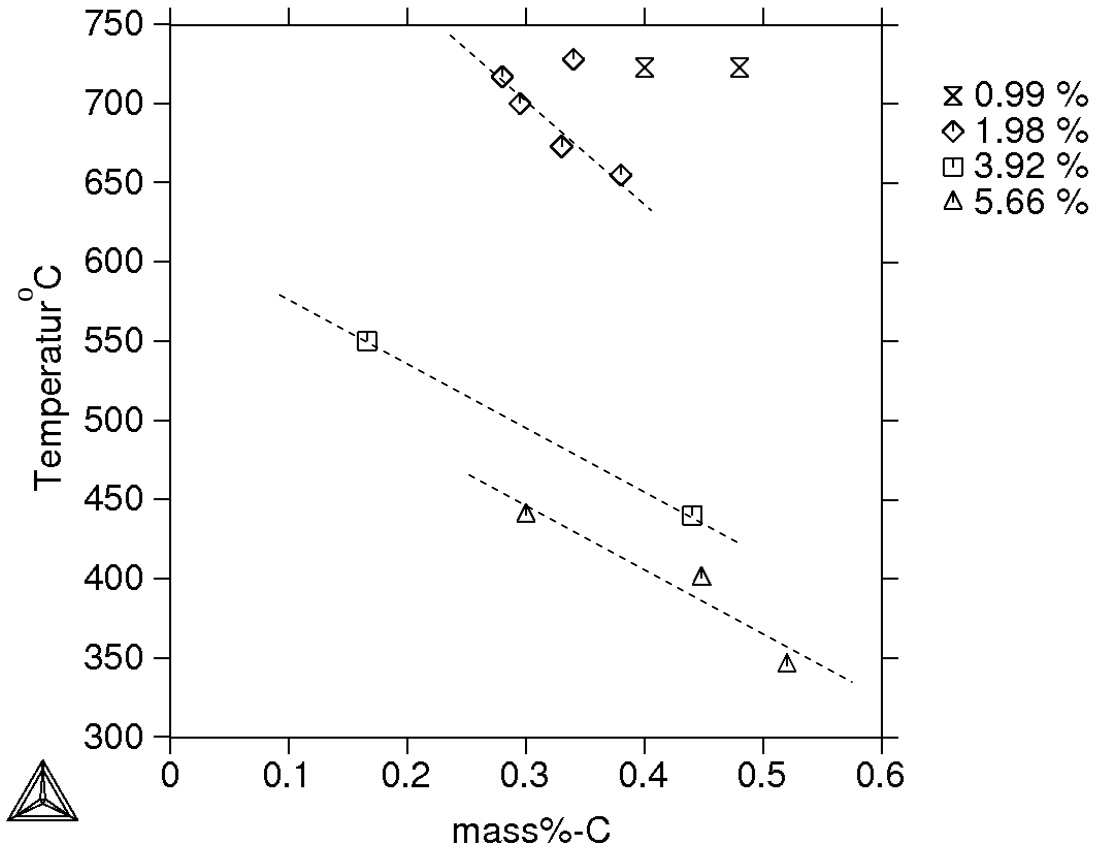
3.92mass% Cr, 550°C



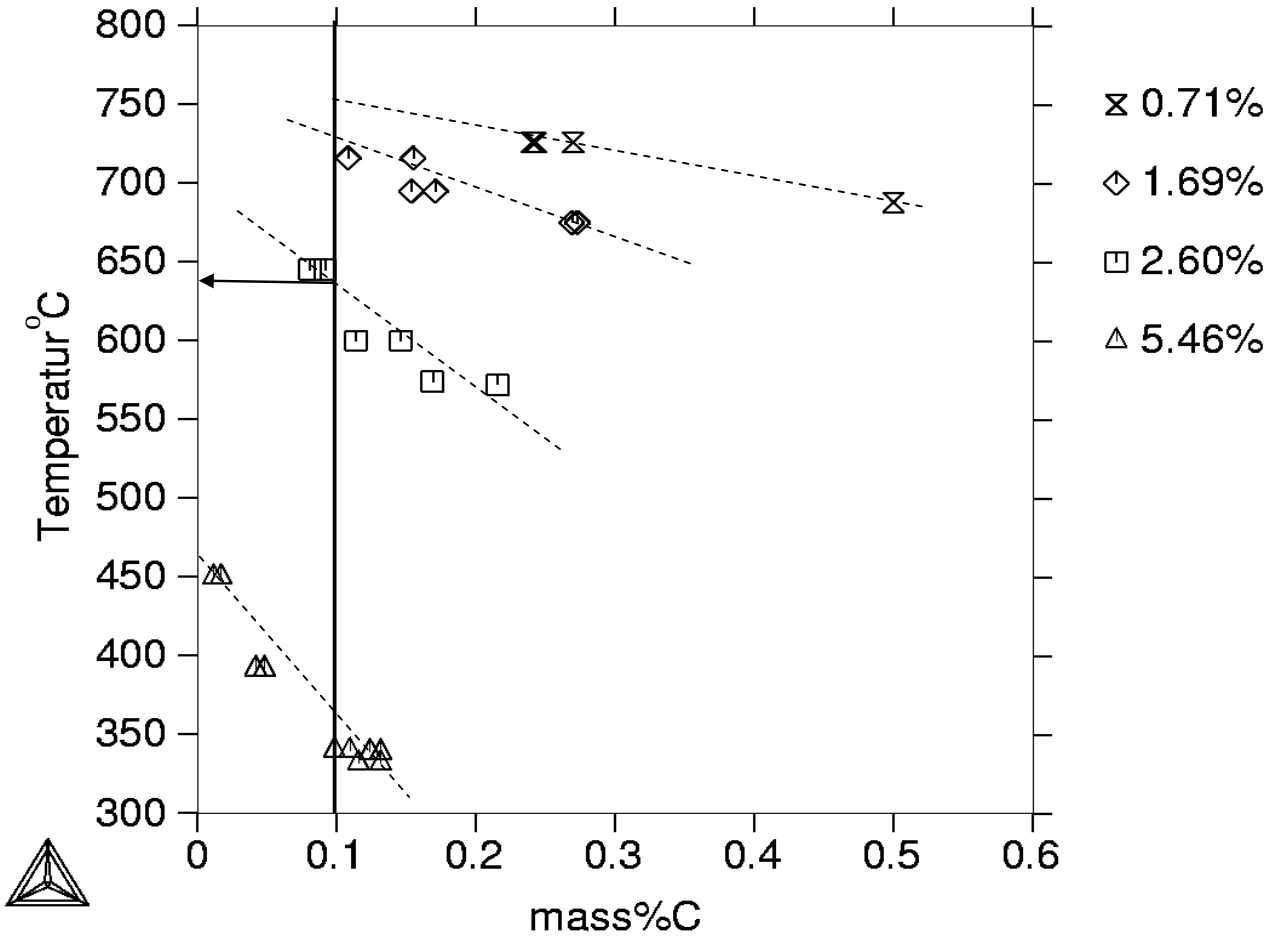
Temperature as function of critical carbon content in Fe-Mn alloys



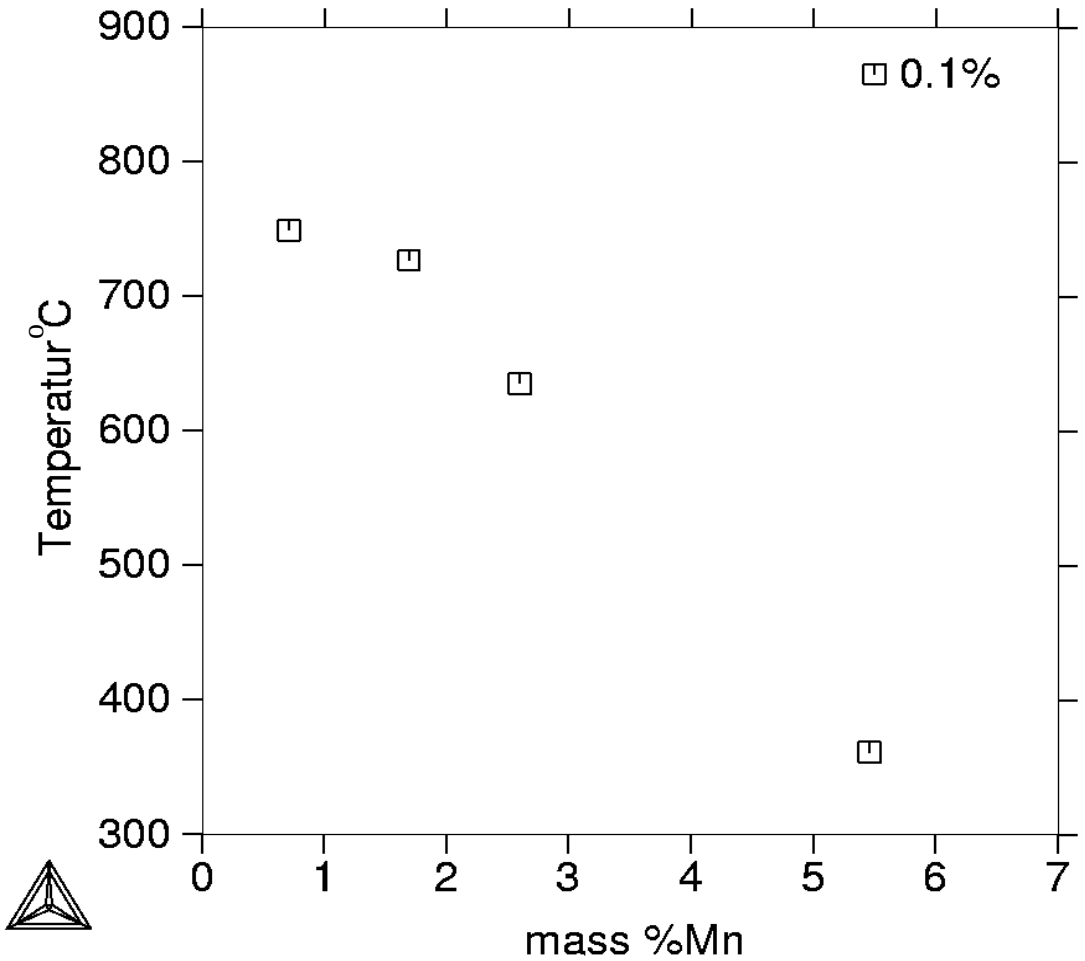
Temperature as function of critical carbon content in Fe-Cr alloys



Critical temperature for Fe-Mn alloys with 0.1 mass% C



Critical temperature as function of Mn content for Fe-Mn alloys with 0.1 mass% C

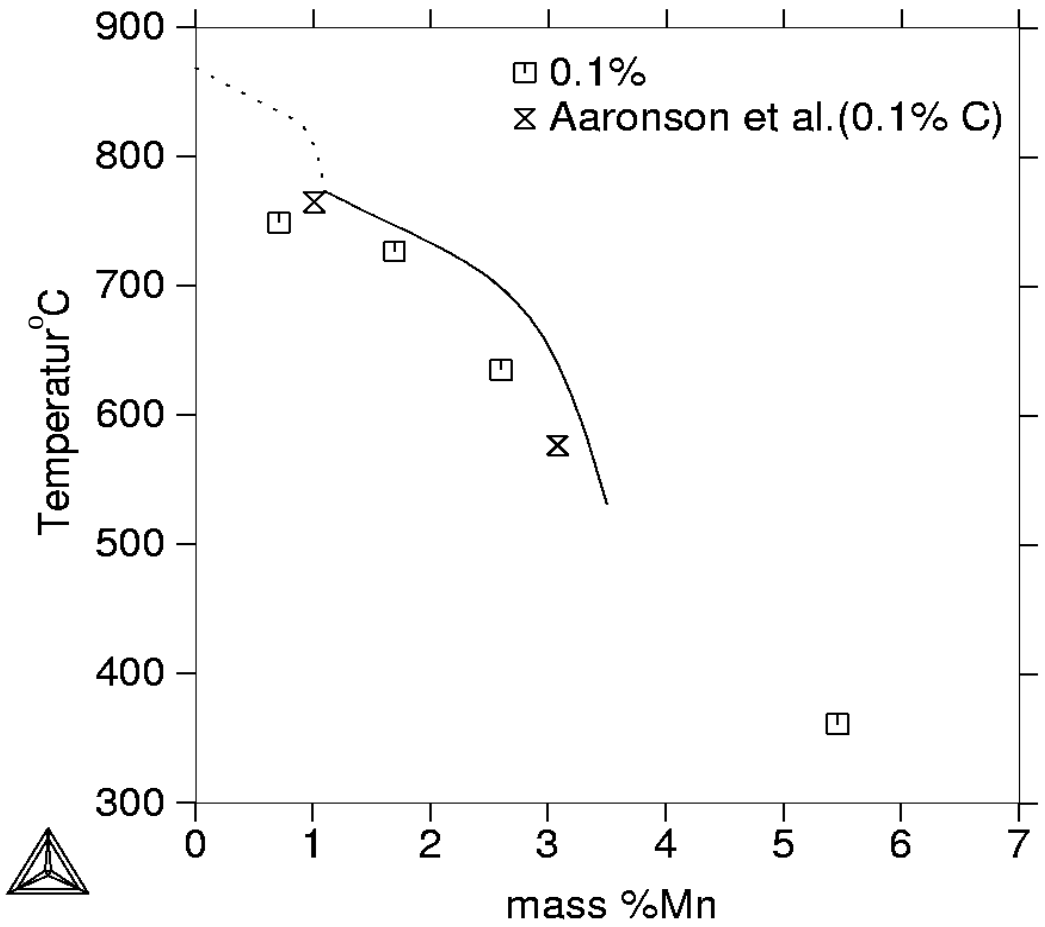


One model for lengthening of Widmanstätten ferrite, upper bainite and lower bainite

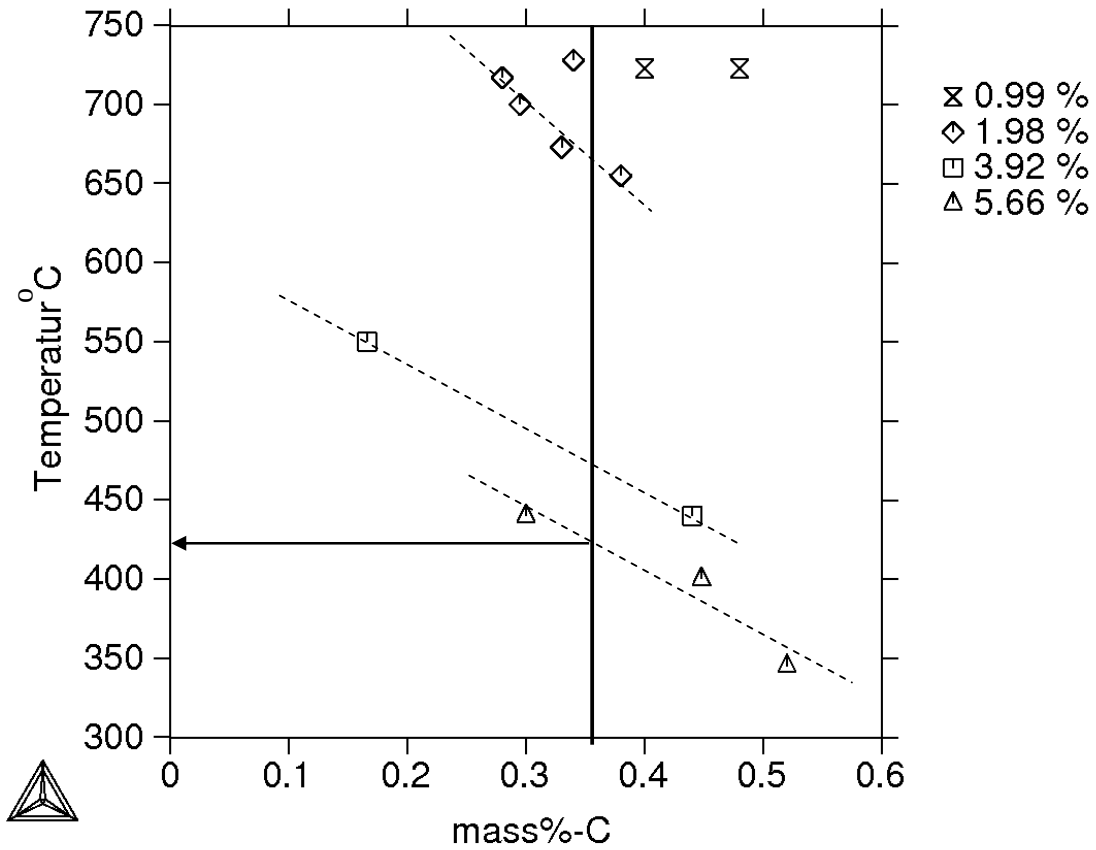
Growth controlled by:

- Constant thermodynamic barrier
- Carbon diffusion
- Paraequilibrium conditions

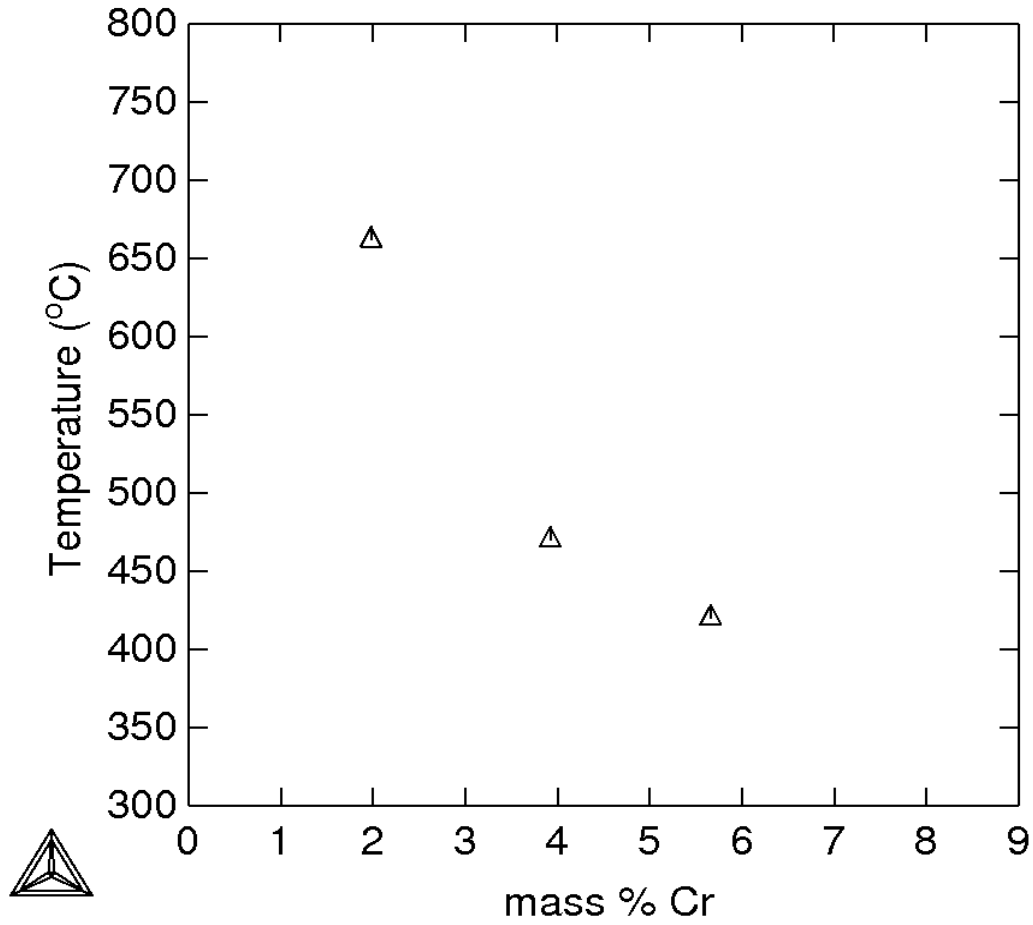
Critical temperature as function of Mn content for 0.1 mass% C compared with WB_s calculation



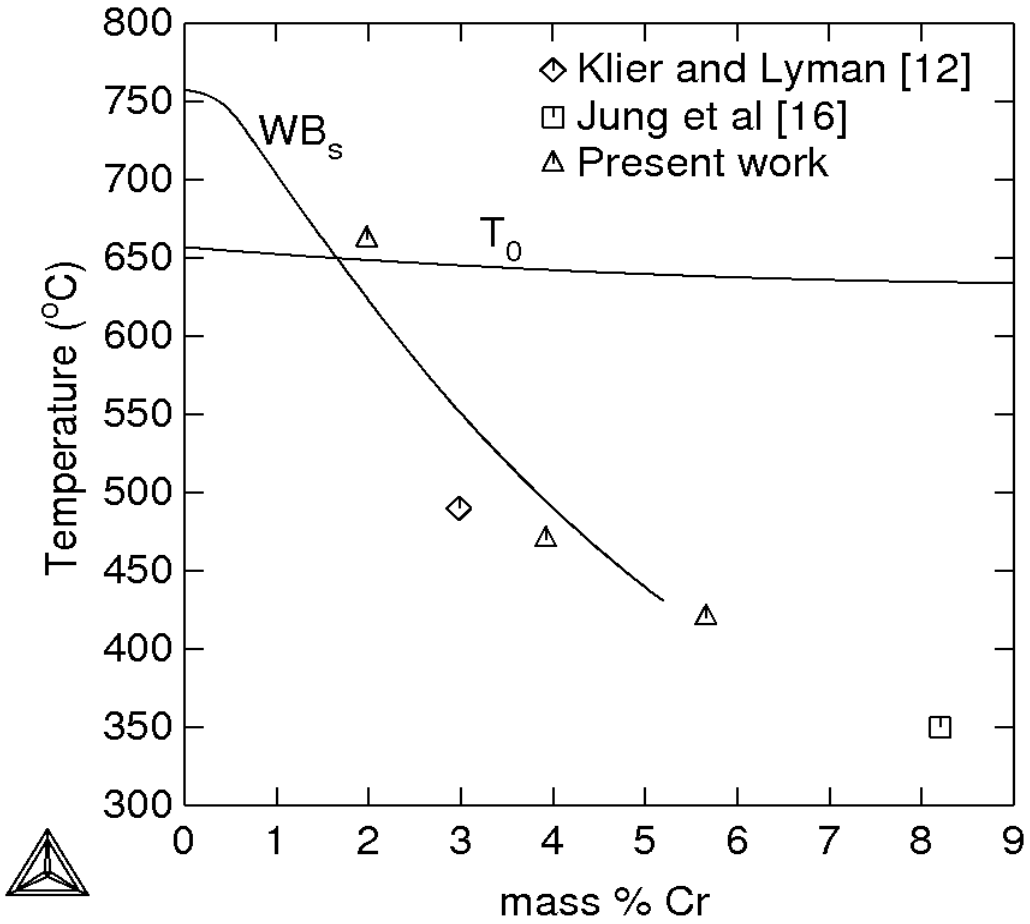
Critical temperature for Fe-Cr alloys with 0.36 mass% C



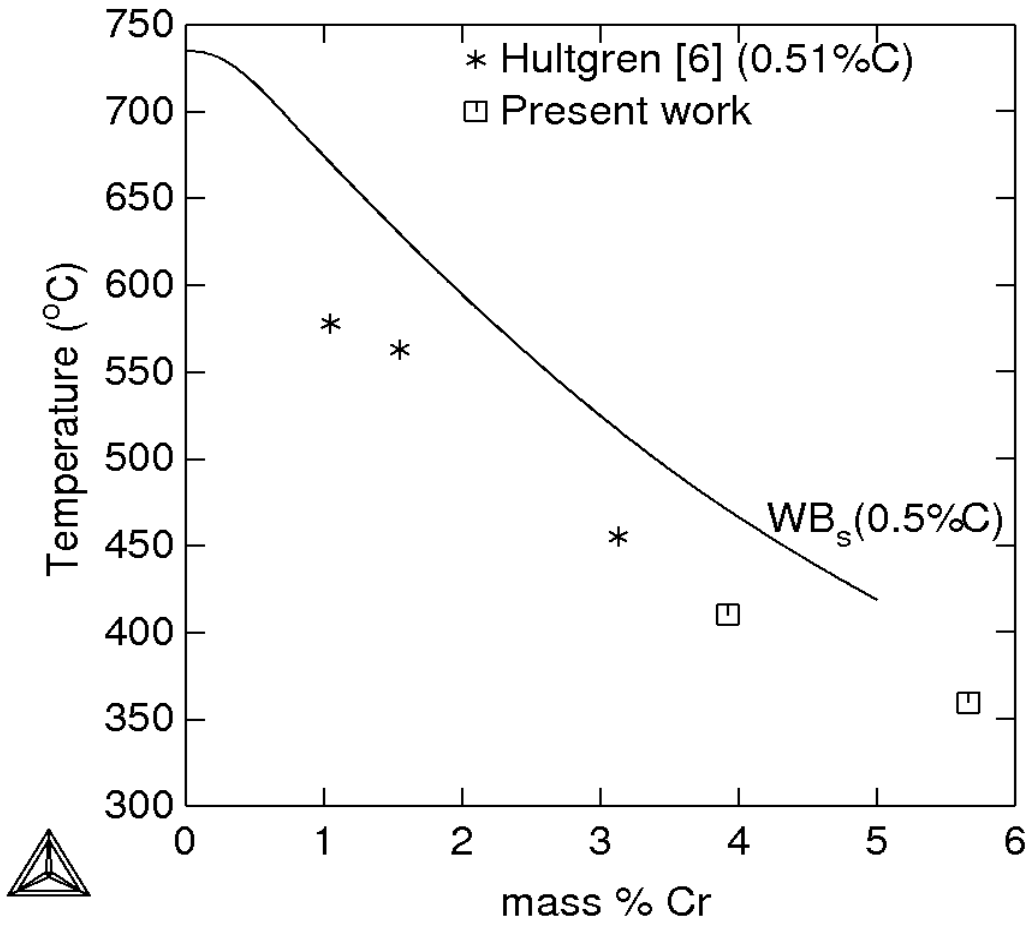
Critical temperature as function of Cr content for Fe-Cr alloys with 0.36 mass% C



Critical temperature as function of Cr content for 0.36 mass% C compared with WB_s calculation



Critical temperature as function of Cr content for 0.51 mass% C compared with WB_s calculation



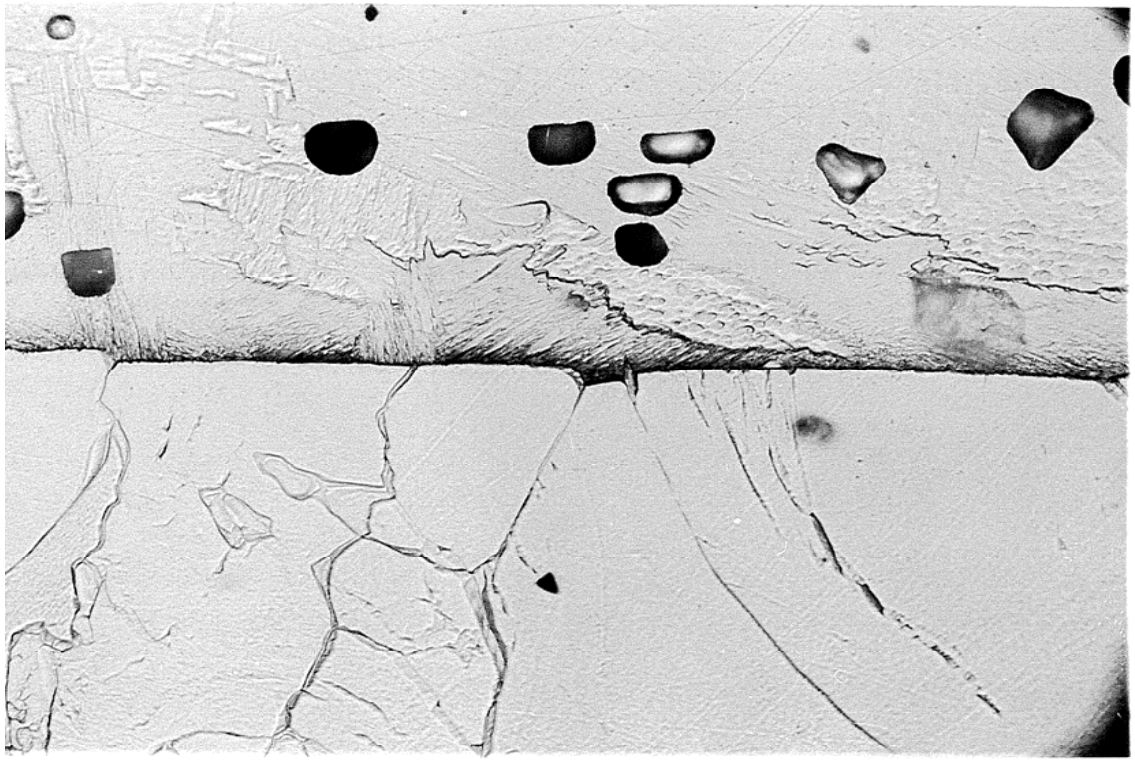
Further work

- Experimental information on Fe-Mo will be evaluated.
- The model for growth of acicular ferrite will be improved using the new experimental information.
- The work on bainite at KTH will continue in the new Center HERO-M.

Massive transformation in Fe-Mn
Experimental work

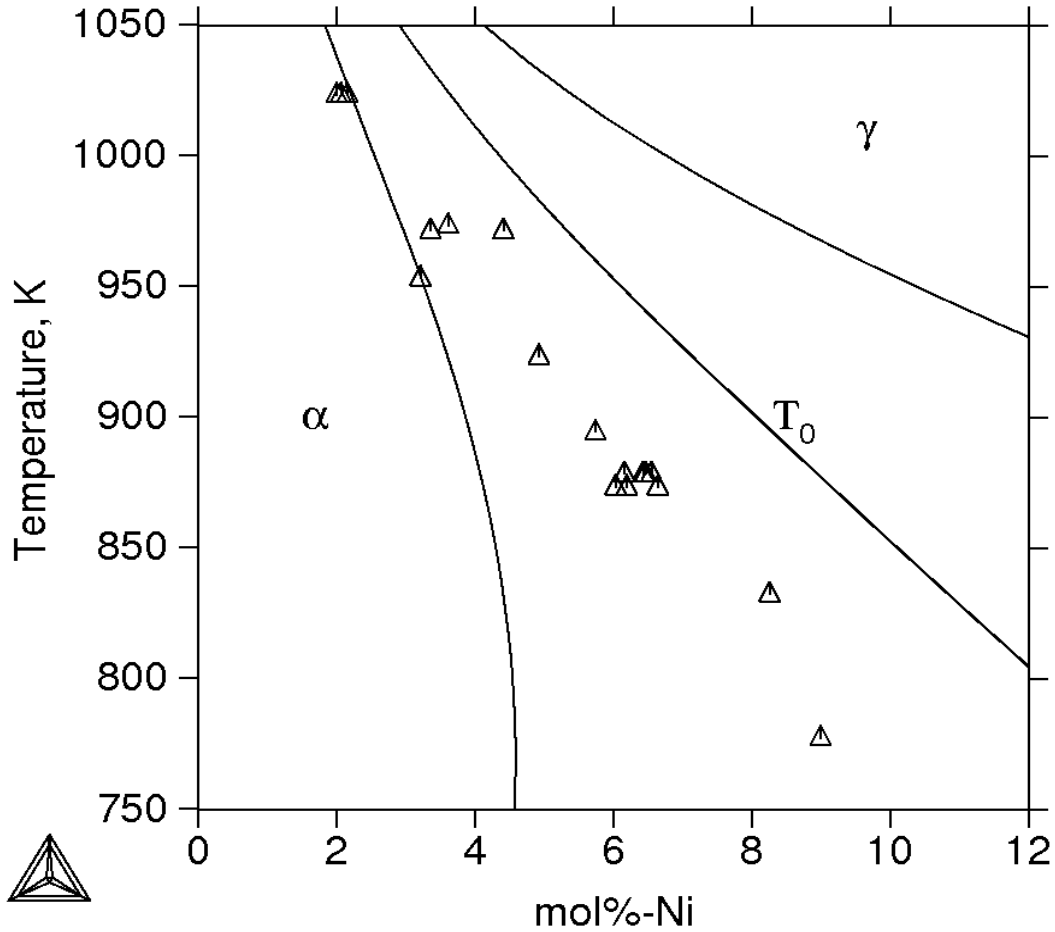
- Diffusion couple of Fe and Fe - 15 mass% Mn alloy annealed 450h at 1500K
- Isothermal heat treatment
- Microstructure studied by LOM
- Measurements of the composition gradients with ASEM

Massive transformation in Fe-Ni
2 min at 650 °C



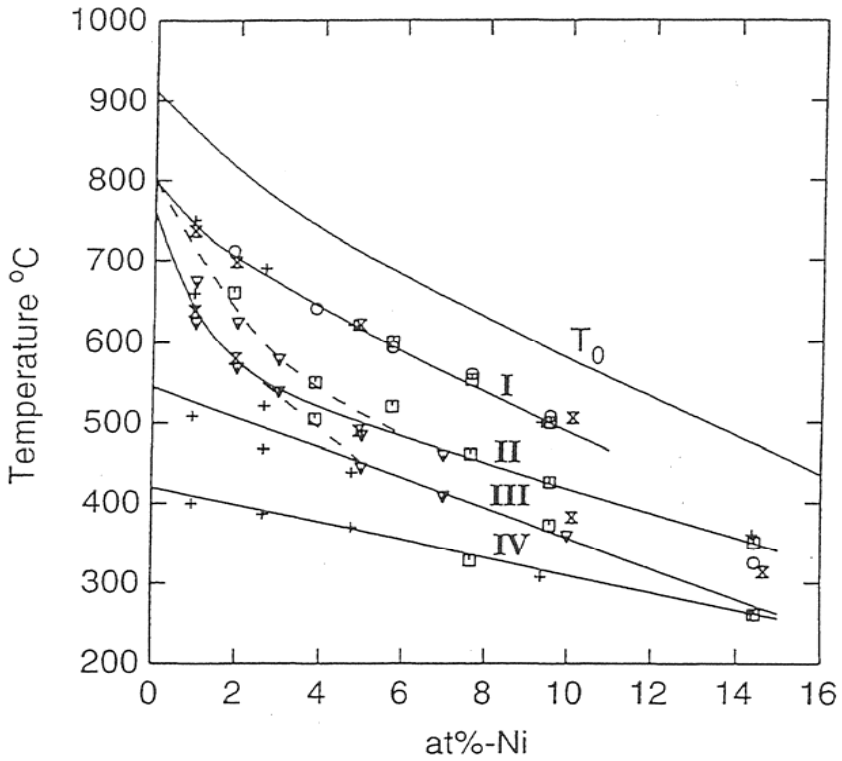
Borgenstam and Hillert, 2000

Limit of the massive growth of ferrite in Fe-Ni

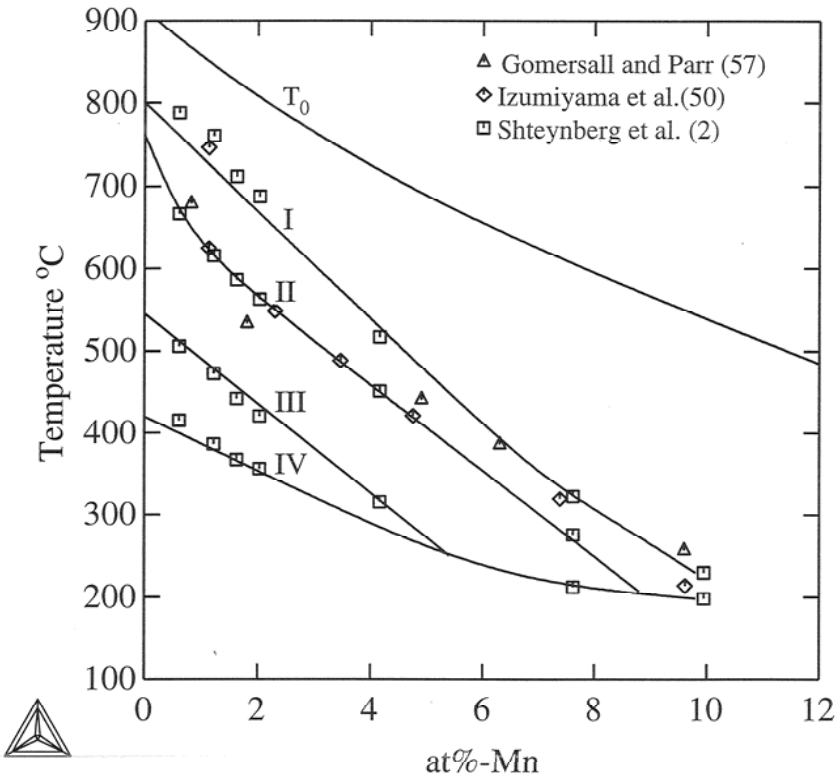


Borgenstam and Hillert, 2000

Plateau temperatures for various partitionless transformations.



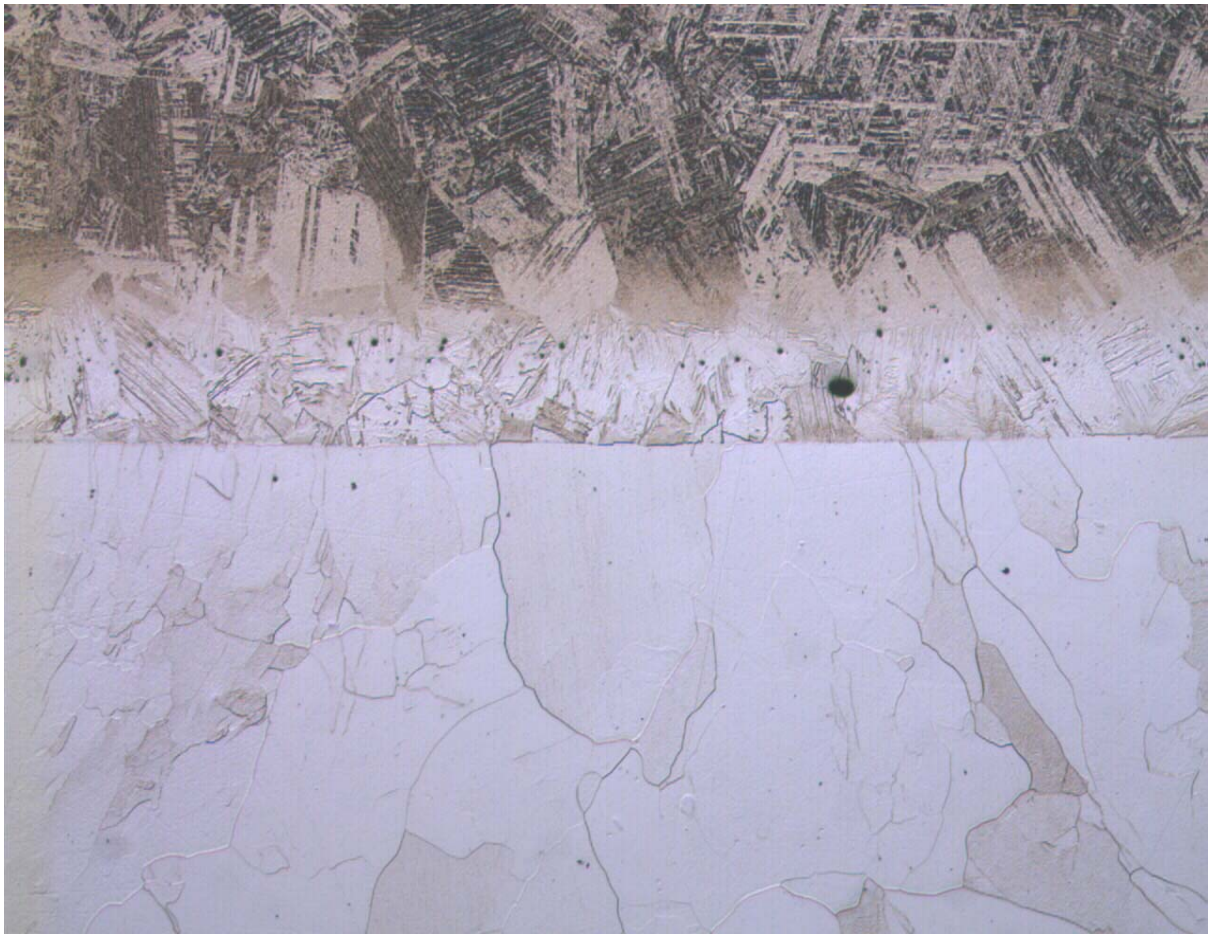
Fe-Ni



Fe-Mn

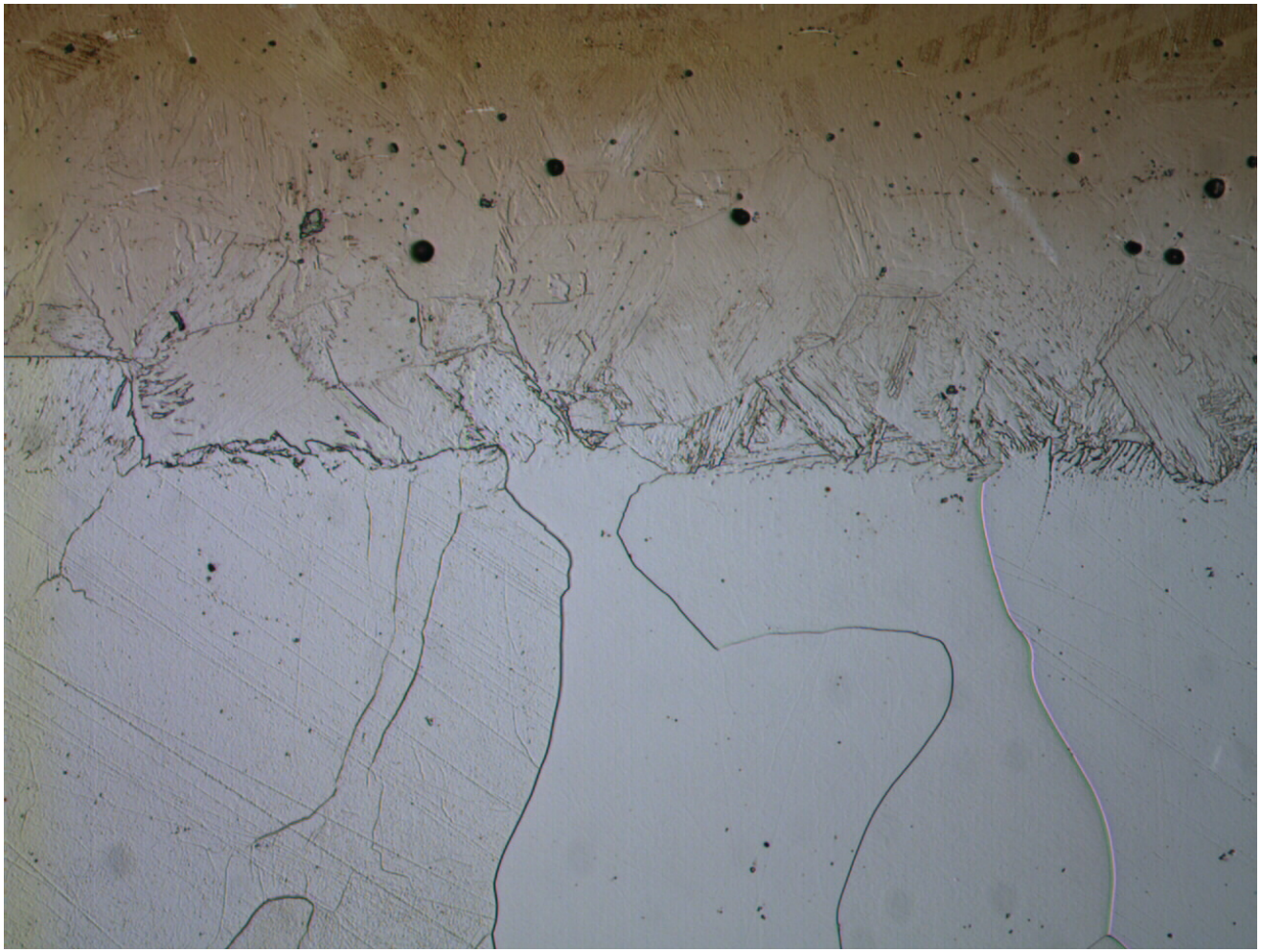
Borgenstam and Hillert

Massive transformation in Fe-Mn
2 min 705°C



Massive transformation in Fe-Mn
2 min 705ºC

Massive transformation in Fe-Mn
2 min 353°C



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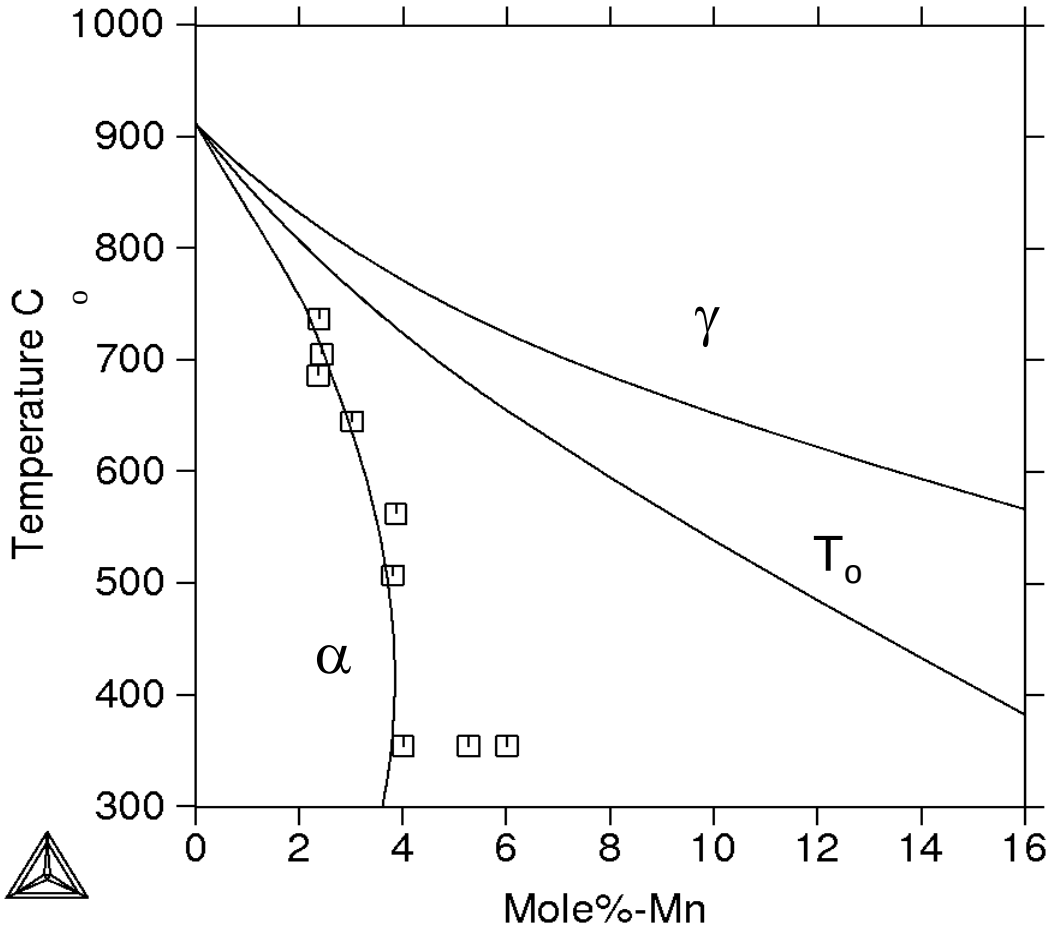
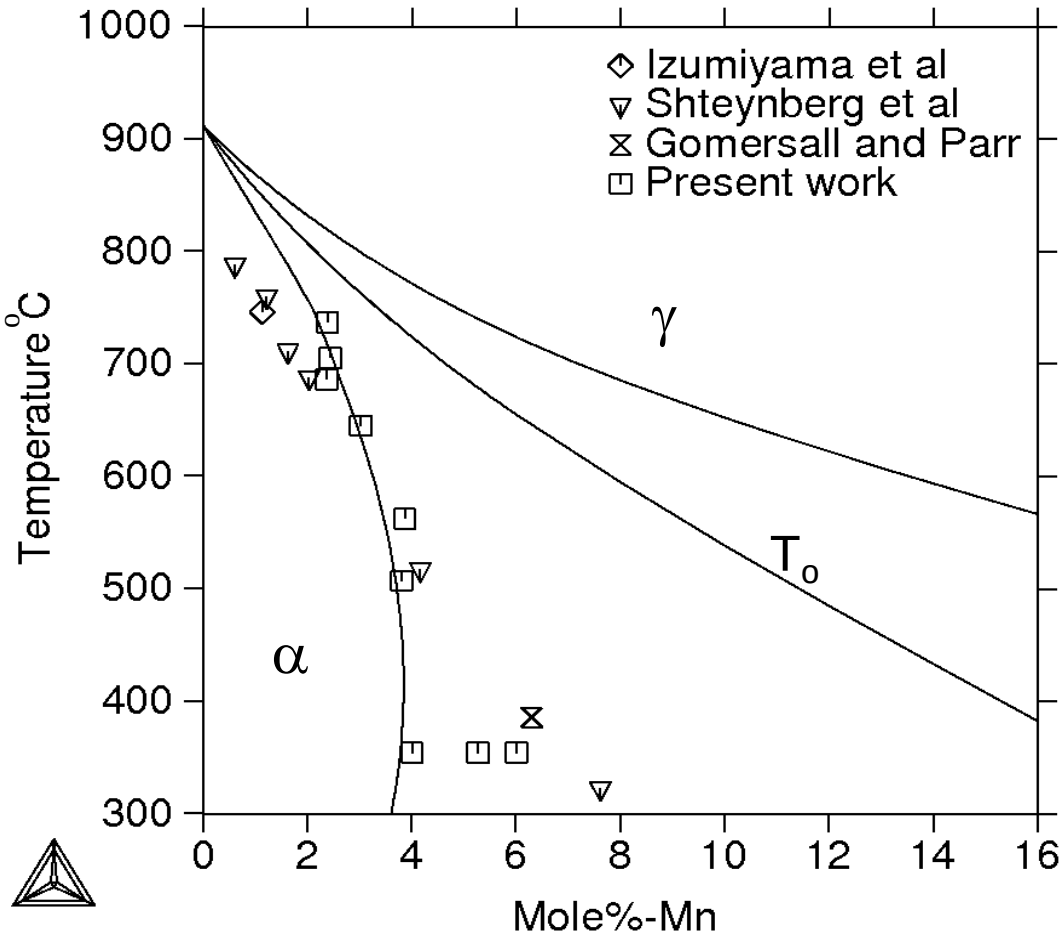


Limit of the massive growth of ferrite in Fe-Mn compared with the plateau temperature for equiaxed ferrite



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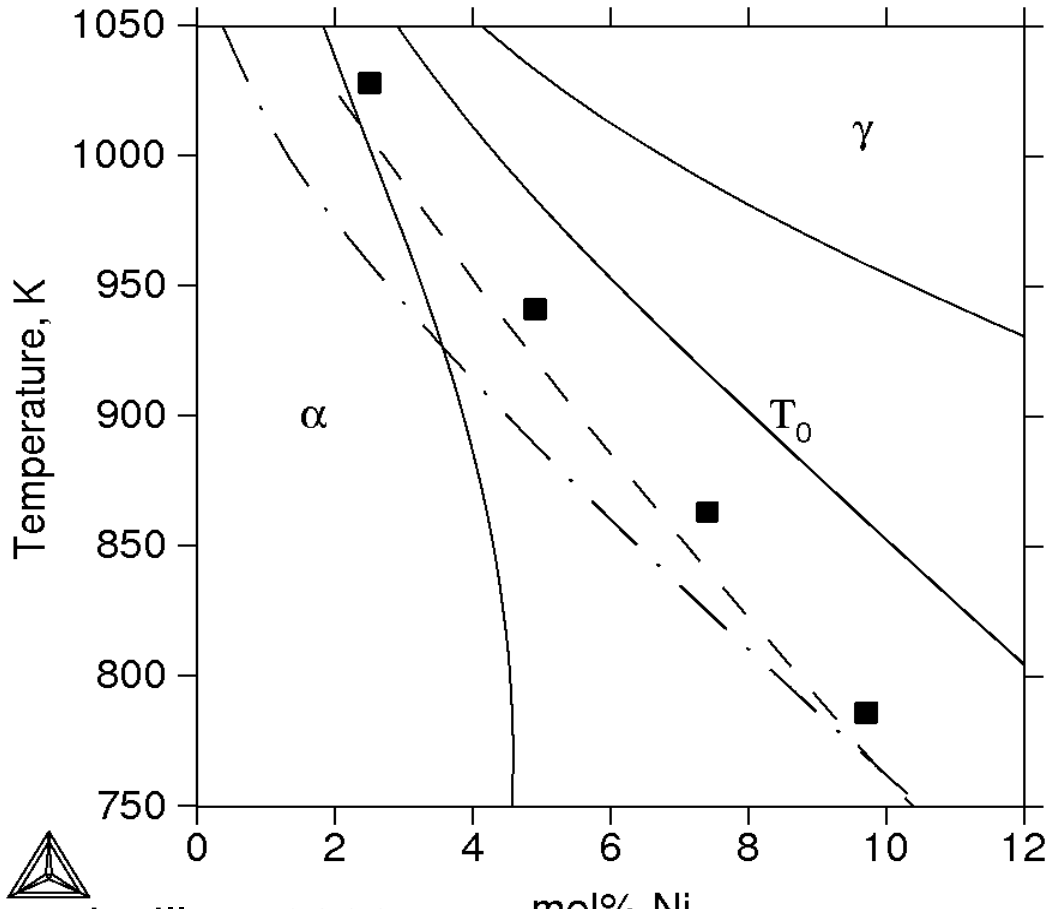

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