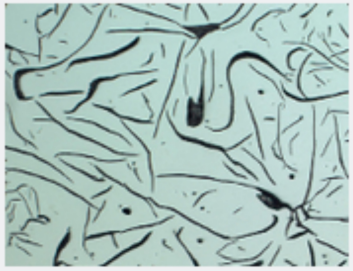
Grey Iron Phase Diagram Generator

How-To-Use Background



1. Enter:

#Material Name= x

#Chemistry:

#C= 3.5	#Si= 1.92	#Al= 0	#Cu= 0	
#Ni= 0	#Co= 0	#Mn= 0	#Mo= 0	
#Cr= 0	#V= 0	#Ti= 0	#P= 0	#S= 0

2a. Enter your Heat/Cool Curve Test Name :

#TestName= NoData

Leave in "**NoData**" if no curve is available and the points in text box below will be ignored.
IF you wish to display heat/cool points change the **NoData** test name above,
delete the example lines in the textbox below and enter your heating, MnS or cooling
curve points in the same format as shown below.

2b. Enter your Heating and Cooling Points:

```
#SAE_Standard_File= GreyIronPDG

# wt%C    Deg.C   %Si   #type
 3.50      793.   1.92  #heat  example
 3.50     1187.   1.92  #MnS   example
 3.50      720.   1.92  #cool  example
#
```

3. Phase Diag.: Click here

Place a name here
(no spaces in name!)

Put your chemistry here
(leave a space after the “=”)

Place test name here.
(no spaces in name!)
If you leave “NoData” file will be ignored
and you will just get a phase diagram
based on chemistry above.

Remove example lines and enter
Your heat/cool/MnS pts here.
(Use the same format)
The points will appear on the Phase Diag.

Submit when done

Result using “NoData” for heat/cool points

Grey Iron Phase Diagram Generator

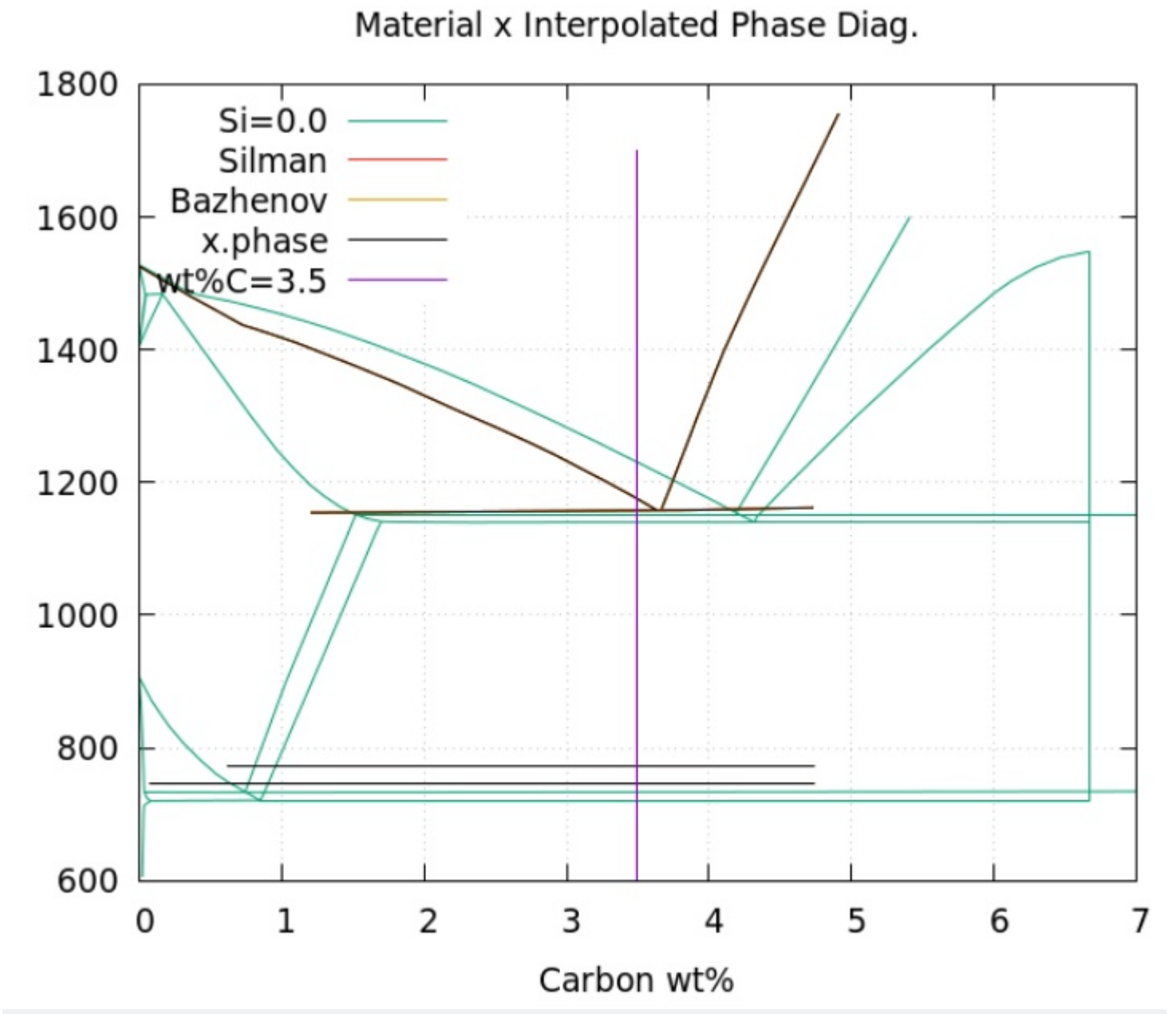
Sponsored by Rassini Frenos, SA, San Martin, Texmelucan, Puebla, Mexico

Results: x Fe_C_Si Phase Diag.

Sun Jun 20 15:00:59 EDT 2021
Got #C= 3.5
Got testname= NoData
No cooling curve pt. file. # getCEpd vers. 1.3 starts.

```
 Silman's Co-efficients:
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
Coeff: 1.000  0.282  0.256  0.115  0.090  0.067 -0.118 -0.149 -0.285 -0.331  0.330  0.260
Equiv: 3.500  0.541  0.000  0.000  0.000  0.000 -0.000 -0.000 -0.000 -0.000  0.000  0.000
 Silman's C.E.=   4.041    ( sCeq= Sum of Coeff * wt% of above terms )
 Silman's Ceut=   3.799    ( sCeut=4.34+BC-sCeq )

 Bazhenov's Co-efficients:
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
Coeff: 1.0    0.30   0.     0.     0.     0.    -0.015  0.     0.     0.     0.33   0.26
Equiv: 3.500  0.576  0.     0.     0.     0.    -0.000  0.     0.     0.     0.000  0.000
 Bazhenov's C.E.=   4.076     ( bCeq= Cwt%+ 0.3*Si +0.33*P -0.015*Mn +0.26*S )
 Bazhenov's Ceut=   3.764     ( bCeut=4.34+BC-bCeq )
 Shobolov's Co-efficients(for VERY high Chromium):
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
Coeff: 1.0   +0.30   0.     0.     0.    +0.07  -0.030  0.    +0.050  0.     0.     0.
Equiv: 3.500  0.576  0.     0.     0.000  0.    -0.000  0.     0.000  0.     0.     0.
 Shobolov's C.E.=   4.076     ( SLCeq= Cwt%+ 0.3*Si -0.03*Mn +0.07*Ni +0.05*Cr)
 Shobolov's Ceut=   3.764     ( SLCeut=4.3+BC-SLCeq )
 Shobolov's wt% Carbide= 35.547   (SCarbide= 14.45 -5.87*SLCeq +2.71*(SLCeq**2)
```

Result using “NoData” for heat/cool points



Collecting points from a heating/cooling curve test

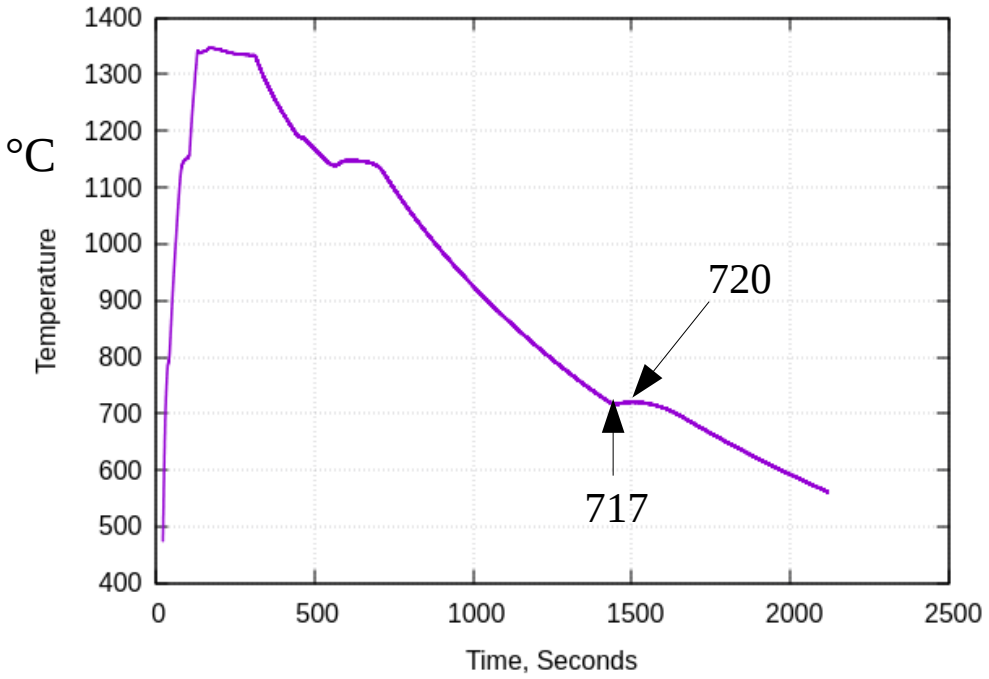


Fig.2a Typical cooling curve from casting

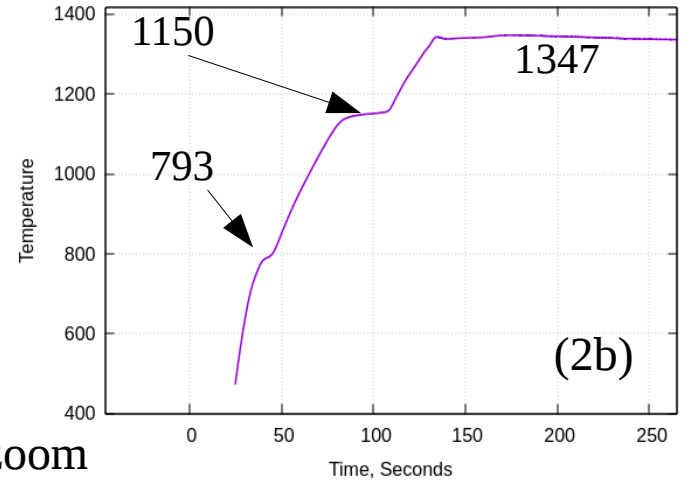
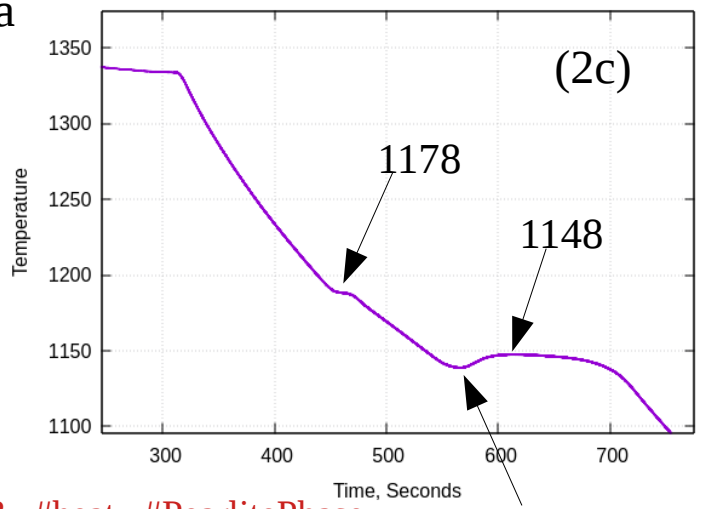


Fig.2b,c zoom of Fig.2a

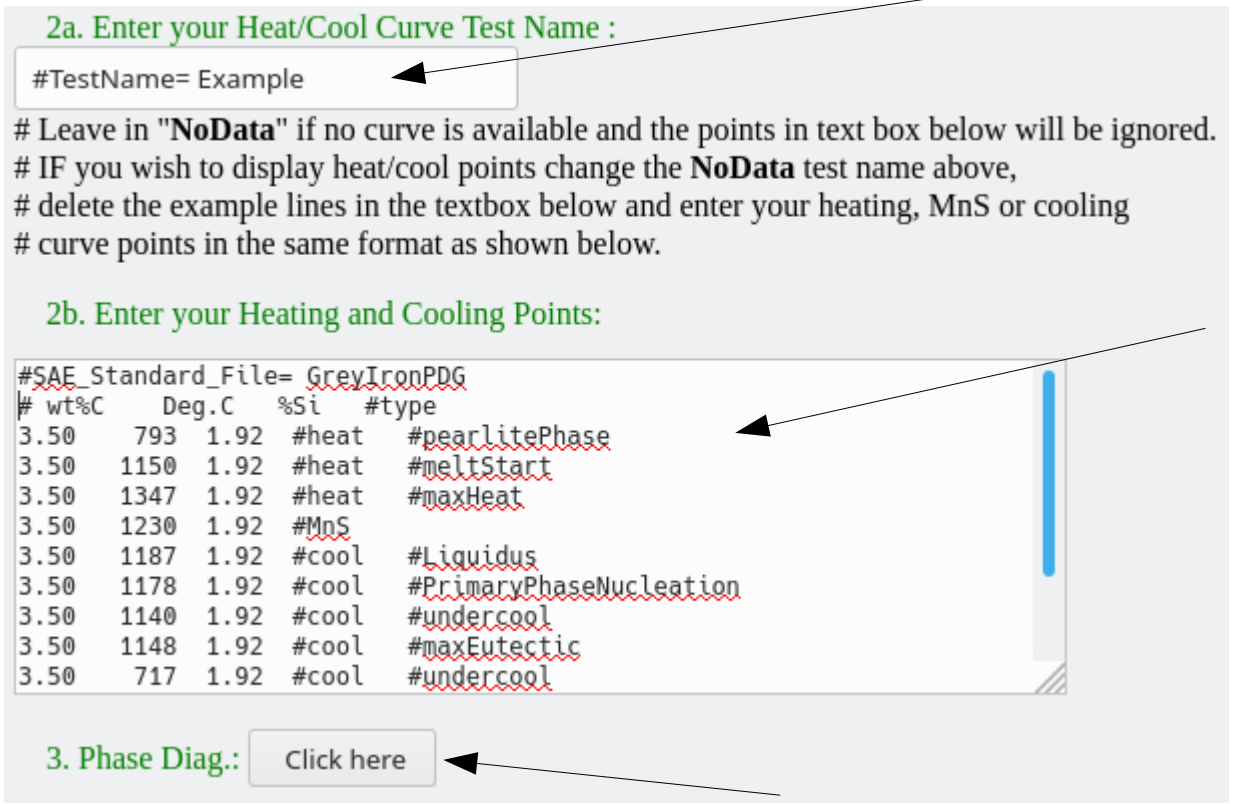


Since the phase diagrams were developed using the cooling curves of the Fe-C; there is the option to incorporate in the graph the cooling key temperature points (#cool) gathered from a heating and/or cooling curve by the user. One can indicate observed temperature points during the heating process (#heat). In addition the MnS temperature points during cooling (#MnS)

```
 793  #heat  #PearlitePhase
1150  #heat  #meltStart
1347  #heat  #maxHeat
1230  #MnS
1187  #cool  #liquidus
1178  #cool  #PrimaryPhaseNucl.
1140  #cool  #undercool
1148  #cool  #maxEutectic
 717  #cool  #undercool
 720  #cool  #maxEutectoid
```

The observed points can be entered into the text box in section 2 (see page 1)

Enter the heat/cool points



Delete “NoData” and enter a name.

Enter your heat/cool points in the textbox with format as shown.

Submit

Result using heat/cool points

Grey Iron Phase Diagram Generator

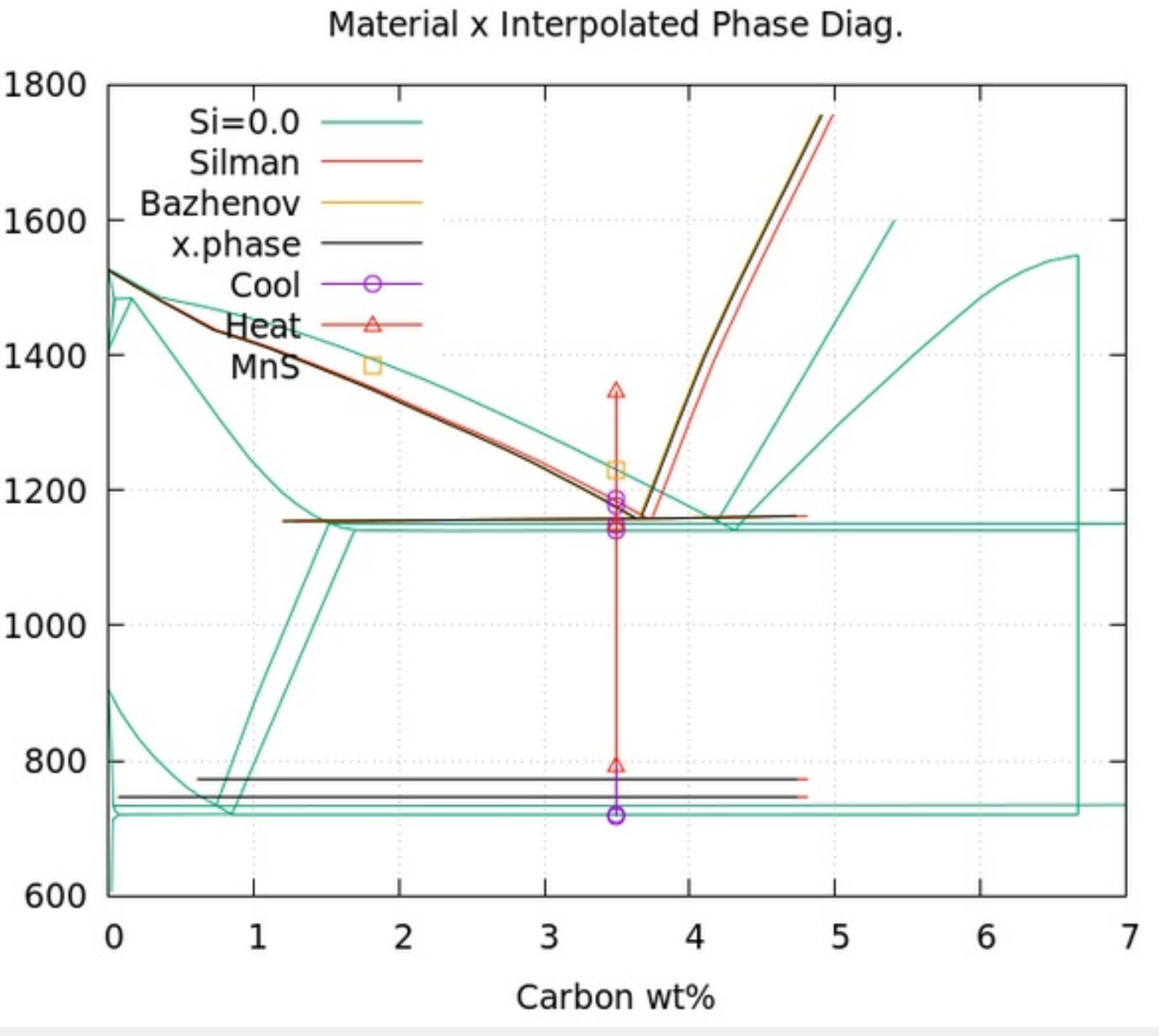
Sponsored by Rassini Frenos, SA, San Martin, Texmelucan, Puebla, Mexico

Results: x Fe_C_Si Phase Diag.

Tue Jun 22 14:48:38 EDT 2021
Got #C= 3.5
Got testname= Example
getCEpd vers. 1.4 starts.

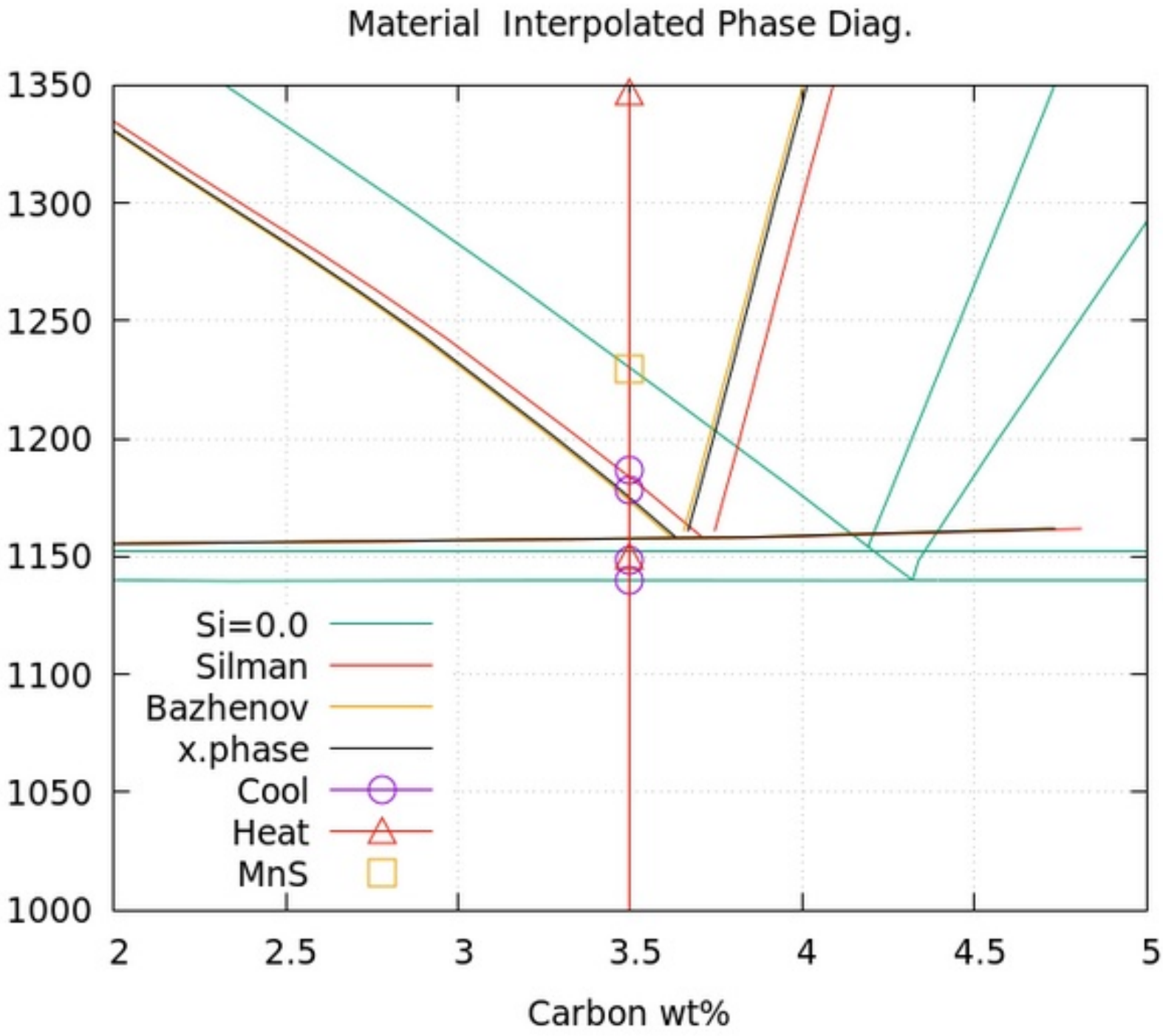
```
 Common Industrial :
 Comm.CE=  4.140, CommCeut=  4.300 diff= -0.160       ( Comm.CE= Cwt% + Si/3.  )

 Silman's Co-efficients:
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.230  0.020  0.000  0.550  0.000  0.200  0.010  0.020  0.053
Coeff: 1.000  0.282  0.256  0.115  0.090  0.067 -0.118 -0.149 -0.285 -0.331  0.330  0.260
Equiv: 3.500  0.541  0.000  0.026  0.002  0.000 -0.065 -0.000 -0.057 -0.003  0.007  0.014
 Silman's C.E.=   3.965    ( sCeq= Sum of Coeff * wt% of above terms )
 Silman's Ceut=   3.875    ( sCeut=4.34+BC-sCeq )

 Bazhenov's Co-efficients:
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.230  0.020  0.000  0.550  0.000  0.200  0.010  0.020  0.053
Coeff: 1.0    0.30   0.     0.     0.     0.    -0.015  0.     0.     0.     0.33   0.26
Equiv: 3.500  0.576  0.     0.     0.     0.    -0.008  0.     0.     0.     0.007  0.014
 Bazhenov's C.E.=   4.088     ( bCeq= Cwt%+ 0.3*Si +0.33*P -0.015*Mn +0.26*S )
 Bazhenov's Ceut=   3.752     ( bCeut=4.34+BC-bCeq )

 Shobolov's Co-efficients(for VERY high Chromium):
       C_wt%   Si    Al     Cu     Ni     Co     Mn     Mo     Cr     V      P      S
Wt.% : 3.500  1.920  0.000  0.230  0.020  0.000  0.550  0.000  0.200  0.010  0.020  0.053
Coeff: 1.0   +0.30   0.     0.     0.    +0.07  -0.030  0.    +0.050  0.     0.     0.
Equiv: 3.500  0.576  0.     0.     0.001  0.    -0.016  0.     0.010  0.     0.     0.
 Shobolov's C.E.=   4.071     ( SLCeq= Cwt%+ 0.3*Si -0.03*Mn +0.07*Ni +0.05*Cr)
 Shobolov's Ceut=   3.769     ( SLCeut=4.3+BC-SLCeq )
 Shobolov's wt% Carbide= 35.465   (SCarbide= 14.45 -5.87*SLCeq +2.71*(SLCeq**2)


sCeq=   3.965  # (Silman's Carb.Equiv.)
sCeut=   3.875  # (Silman's Carb.Eutectic)
Compute the Carb. Equiv. WITHOUT the Si contribution:
sCeqLessSi=  3.423  # Silman
bCeqLessSi=  3.512  # Bazhenov
SLCeqLessSi=  3.495  # Shobolov
(These will be used to shift the PhaseDiag after interpolations.)

Silman Additional Elem. Phase Diag. shift: 0.077

Bazhenov Additional Elem. Phase  Diag. shift: -.012
```

Result using heat/cool points



Result using heat/cool points

(zoom)



Result using heat/cool points

Appendix 1:
Simulation input Chemistry:

```
#Material= x
#C= 3.5
#Si= 1.92
#Al= 0
#Cu= 0.23
#Ni= 0.02
#Co= 0
#Mn= 0.55
#Mo= 0
#Cr= 0.2
#V= 0.01
#Ti= 0.01
#P= 0.02
#S= 0.053
#TestName= Example
```

Appendix 2:
Head/Cool input pts: Example:

```
#HotCold
#SAE_Standard_File= GreyIronPDG

# wt%C    Deg.C   %Si   #type
3.50    793  1.92  #heat   #pearlitePhase
3.50   1150  1.92  #heat   #meltStart
3.50   1347  1.92  #heat   #maxHeat
3.50   1230  1.92  #MnS
3.50   1187  1.92  #cool   #Liquidus
3.50   1178  1.92  #cool   #PrimaryPhaseNucleation
3.50   1140  1.92  #cool   #undercool
3.50   1148  1.92  #cool   #maxEutectic
3.50    717  1.92  #cool   #undercool
3.50    720  1.92  #cool   #max.Eutectoid

#
#TestName= Example
```