

# Basic Heat-Treating of Carbon Steel!

AKA: Use of Voodoo and other Dark Arts in  
Blacksmithing!

Disclaimer: Misspellings, misuse of grammar are all my fault! Heat Treating info is to the very best of my knowledge!!

Doug Winberg

## Pat and Doug's heat treating adventure outline;

1. Intro, Many ways to skin a cat .....VooDoo
2. Goals of heat treat: minimize grain size and realize a useable hardness and toughness
3. Grain size
4. Hardness ...Toughness
5. Eutectic steel hyper hypo .75 carbon Carbides other than iron
6. Steel states Steel soup , Ferrite pearlite cementite Austenite Martensite
7. Iron Carbon Diagram ac1 ac3 Currie point
8. Carbides
9. Homogenizing Spheroidizing Austenitizing, quenching, tempering
10. Ovens, salt pots, the forge compromises
11. Temper lines
12. Etching
13. Patterning
14. Forge building
15. Burners

# Heat treat outline! Or what do I do now?

1. Heat to approximately 1625 degrees F ( Or better yet, get a number from Carbon Iron Diagram) Do not soak longer than it takes for blade to come up to temp! Let cool to black heat (900F) or less. You are setting up the steel to make carbides. Not necessary for Hypoeutectic steel. I do it anyway!
2. Spheroidizing: Heat to 1325F than allow to cool to black heat three separate times. You are dispersing carbon evenly through the steel, getting ready to make the best Austenite.
3. Heat to Hardening temp. (Approximately 1500F) Check out my chart or reliable book for best temp.  
Use 1500F if you are trying mystery metal!!
4. Quench immediately. You are making Martensite. Allow to cool to room temp.
5. Temper: Three tempering cycles work best for steels with alloys in them.. ie 52100 or 5160. Triple tempering will not hurt for any knife steel!

## Common Knife steels and temps:

5160:	Hardening temp:	1525F	
	Temper temp:	335F	ABS Test Knife? Use this temp!!
52100:	Hardening temp:	1555F - 1500F	1550 in a salt pot
	Temper temp:	450F	To start
1084:	Hardening temp:	1500F	
	Temper temp:	500F	to start
1095:	Hardening temp:	1475F	
	Temper temp:	525F	To start
O1:	Hardening temp:	1455F - 1500F	(1475F) soak for 30 mins
	Temper temp:	450F	to start
W1:	Hardening temp:	1400F -1550F	
	Temper temp:	390F	to start
L6:	Hardening temp:	1455F - 1550F	
	Temper temp:	450F	to Start
S7:	Hardening temp:	1700F	
	Temper temp:	750F	RC55

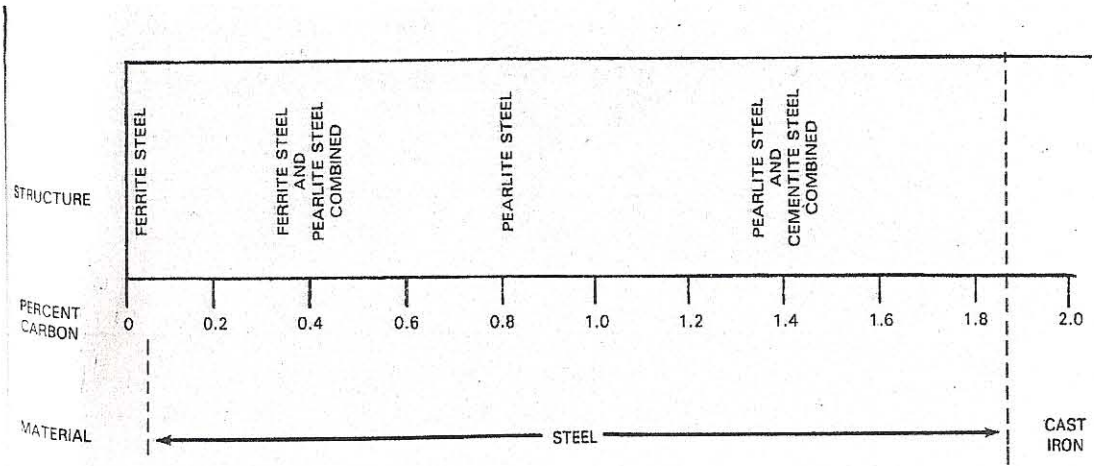
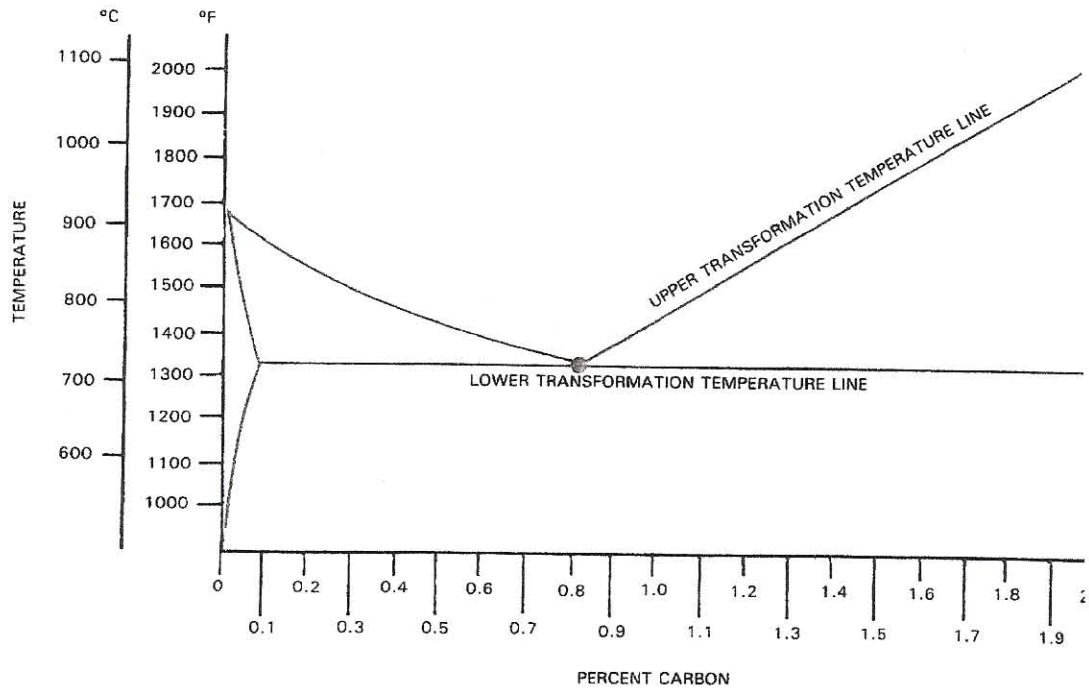


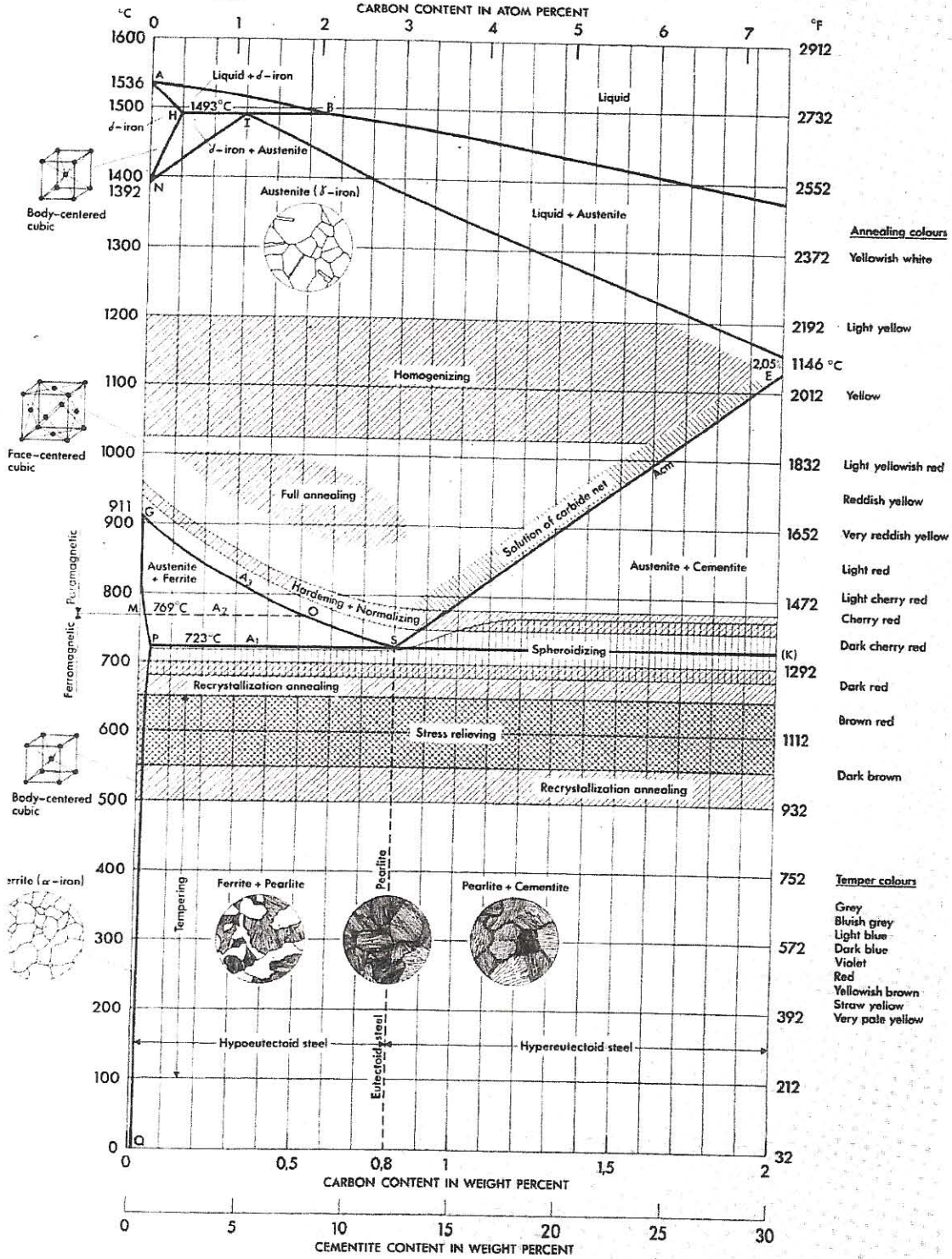
Fig. 9-3. Chart shows effect of percentage of carbon on presence of ferrite, pearlite, and cementite in steel.

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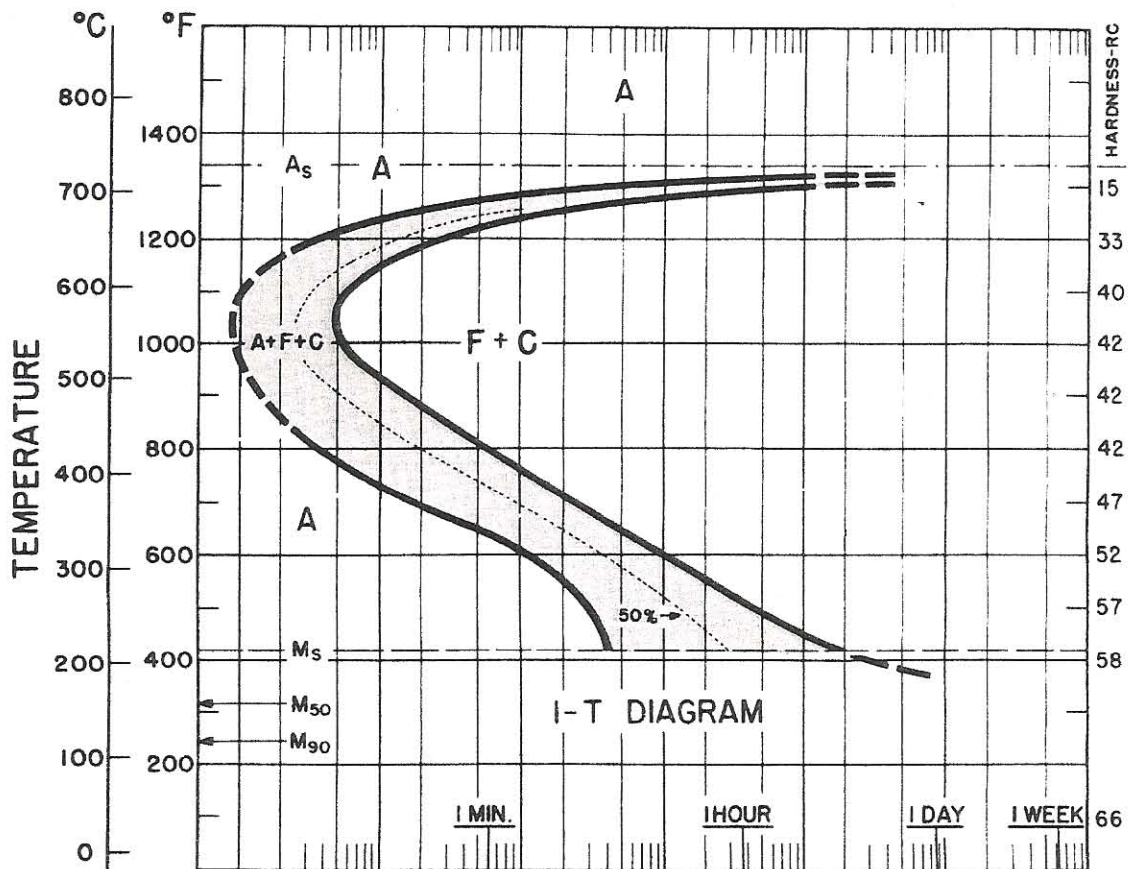


# IRON-CARBON EQUILIBRIUM DIAGRAM

## STEEL PART



Color	Temperature	
	°F	°C
Pale yellow . . . . .	428	220
Straw . . . . .	446	230
Golden yellow . . . . .	469	243
Brown . . . . .	491	255
Brown dappled with purple . . . . .	509	265
Purple . . . . .	531	277
Dark blue . . . . .	550	288
Bright blue . . . . .	567	297
Pale blue . . . . .	610	321



## Books:

Metallurgy Fundamentals     under \$50.00 (Good first Metallurgy book)  
By; Daniel A. Brandt  
91-22280  
Centaur Forge 414-763-9175

Heat Treater's Guide, 2nd edition, Practices and Procedures for Irons and Steels (Good book for the serious heat treater )  
By ASM

Amazon (Buy this one used Please, over \$300.00 new!!!!!!!!!! I paid full price!!)

Metals Handbook, Ninth Edition, Volume 4, Heat treating (Good book for the over the top wacko!!)  
By ASM

Amazon (Buy it used please \$300.00 new!!!!)

## Other Stuff:

High and low temp salt;

Jeff Carlisle ( Carlisle Metal smiths) at 1-406-452-1246  
swain@3rivers.

Low temp salt:

Brownell's bluing salt Oxynate number 7  
1-800-741-0015

## Cool Web Site:

<http://www.dfoggknives.com> (Have fun, you will be in this site forever!!)