

Steel Type : Quenched and Tempered Steel

Steel Grade: 40(GB699-65)

Property Entry Summary

Steel Grade	40
Steel Classification	Quenched and Tempered Steel
General	Steel Grade Comparison, Chemical Composition
Heat Treatment Parameter	Critical temperature, Normalizing, Quenching, Tempering
Transformation Curve	Continuous Cooling Transformation Curve, Temperature Time Transformation Curve, Phase Equilibrium Transformation

General

Steel Grade Comparison

Soviet Union (ГОСТ)	The USA (AISI)	Britain (BS)	Japan (JIS)	French (NF)
40	1040	$E_{n8}D$ S116	S40C	C42

Chemical Composition (%)

C	Si	Mn	P	S	Cr	Ni
0.37~0.45	0.17~0.37	0.50~0.80	≤0.04	≤0.04	≤0.25	≤0.25

Reference

- [1] Zeng Zhengming. The Handbook of Practical Steel Materials [M]. Electricity Press of China, 2005: 232-279,310-453, 501-512.
- [2] Hu Zhizhong. The Handbook of Steel and Its Heat Treatment Curve. Beijing: Defence Industry Press, 1987.
- [3] Lin Huiguo, Lin Gang. The Handbook of Steel Grade [M]. Beijing: Mechanical Industry Press, 1993: 9-71, 241-262.

Heat Treatment Parameter

Critical Temperature and Heat Treatment Condition

Critical Temperature (°C)				Heat Treatment Condition					
A _{c1}	A _{c3}	A _{r1}	A _{r3}	Normalizing	Quenching			Tempering	
724	790	680	760	Temperature (°C)	Temperature (°C)	Cooling agents	HRC	Temperature (°C)	HRC
				840~860	830~850	water	53~58	480~520	28~32

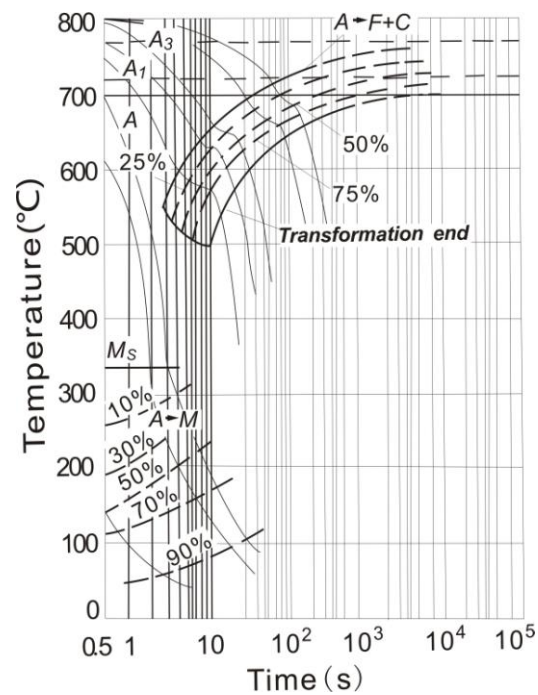
Reference

- [4] Hu Guangli. Heat Treatment of Steels. Beijing : Defence Industry Press, 1985.
- [5] Bao Xintao. Practical Handbook of Heat Treatment of Steel . Shanghai: Science and Technology Press of Shanghai, 2009.

Transformation Curves

Continuous Cooling Transformation (CCT) Curve

Element (wt%)	C	Si	Mn	Cr	Ni
	0.43	0.24	0.68	0.13	0.25
Grain size	-----				
Austenitizing temperature (°C)	850				

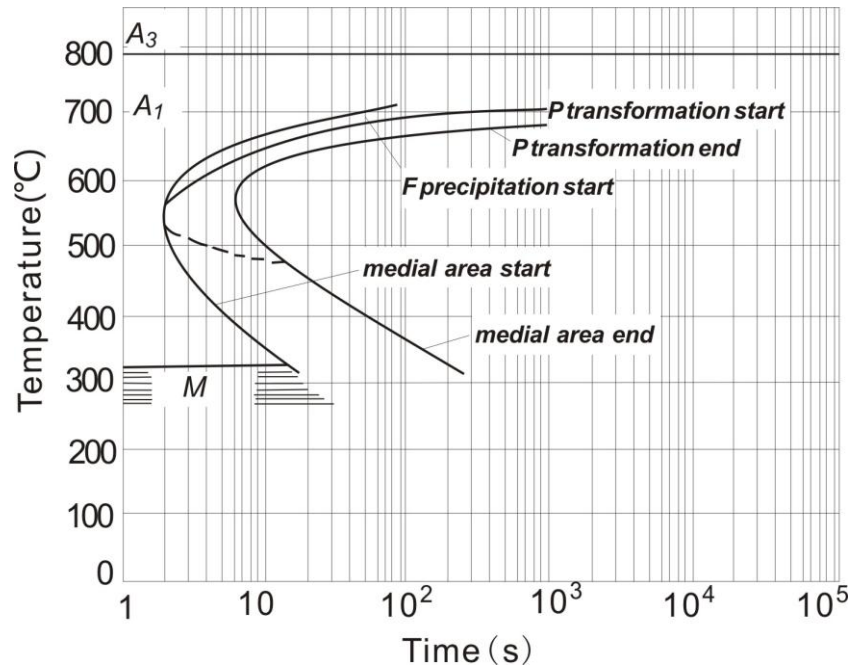


Reference

[6] Hu Zhizhong. The Handbook of Steel and Its Heat Treatment Curve. Beijing: Defence Industry Press, 1987.

Temperature Time Transformation (TTT) Curve

Element (wt%)	C	Mn
	0.44	0.66
Grain size	-----	
Austenitizing temperature (°C)	850	

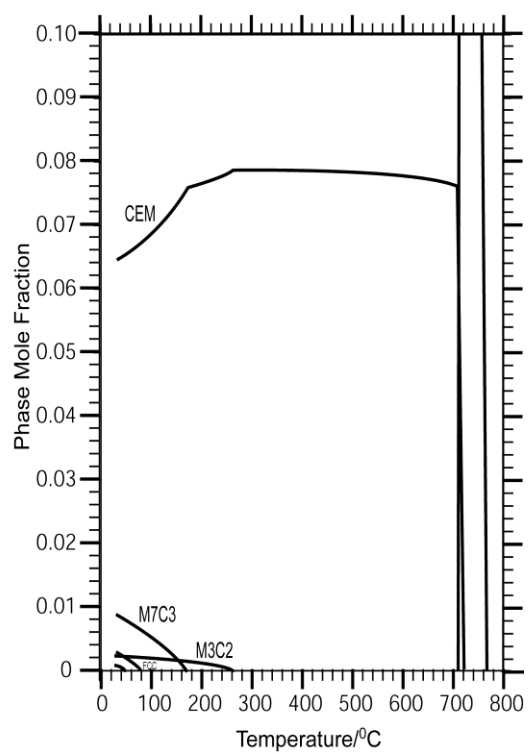
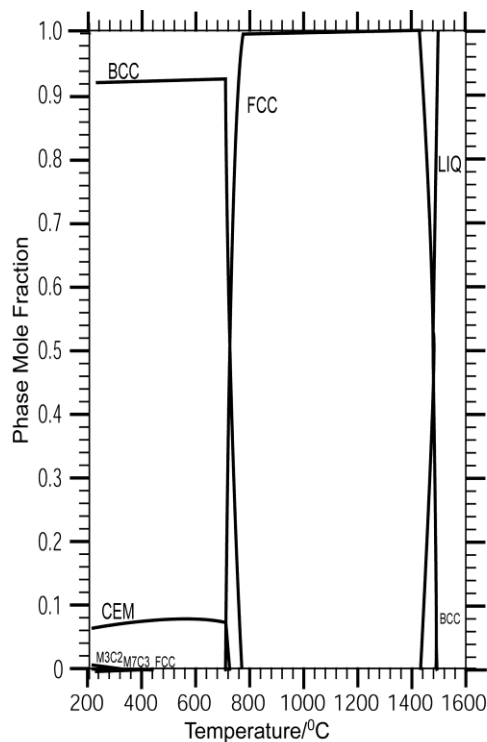


Reference

- [8] H. Yu, S.G. Mhaisalkar. Time–temperature transformation (TTT) cure diagram of a fast cure non-conductive adhesive, Thin Solid Films 504 (2006) 331 – 335.
- [9] Hu Zhizhong. The Handbook of Steel and Its Heat Treatment Curve. Beijing: Defence Industry Press, 1987.

Equilibrium Phase Transformation (EPT) Curve

Element (wt%)	C	Si	Mn	Cr	Ni
	0.40	0.30	0.65	0.61	1.20
Phases considered	<i>Liquid, Fcc, Bcc, M3C2, M7C3, Cementite;</i>				
Phases rejected	<i>Dia, Graph, Fech_chi, Fe4n_1p1;</i>				
Calculation condition	$P=10^5\text{Pa}$, $N=1\text{mole}$				
Database	TCFE3				
Software package	Thermo-Calc				



Remarks

[10] Sundman B, Jansson B, Andersson J-O. The Thermo-Calc databank system. Calphad, 1985,9:153-190.