

Role of Metallographic studies in characterization of Ductile Cast Iron

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Property	Desired value
UTS	300MPa
YS	200Mpa
Elongation	12%
Static Fracture Toughness	55Mpa

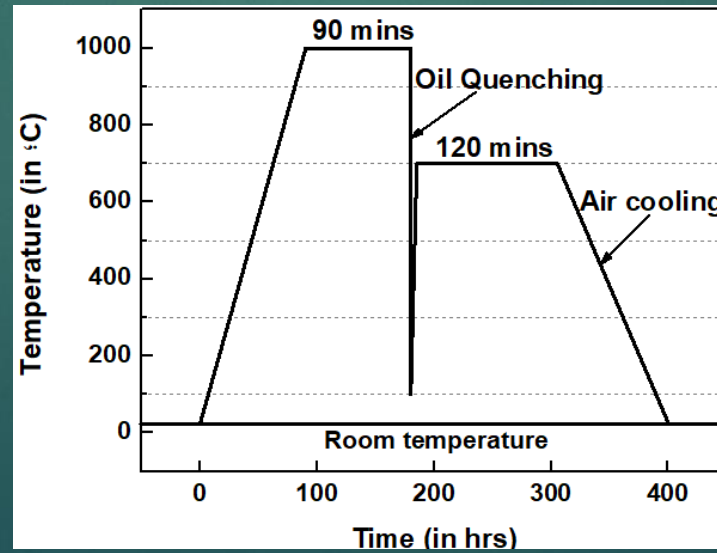
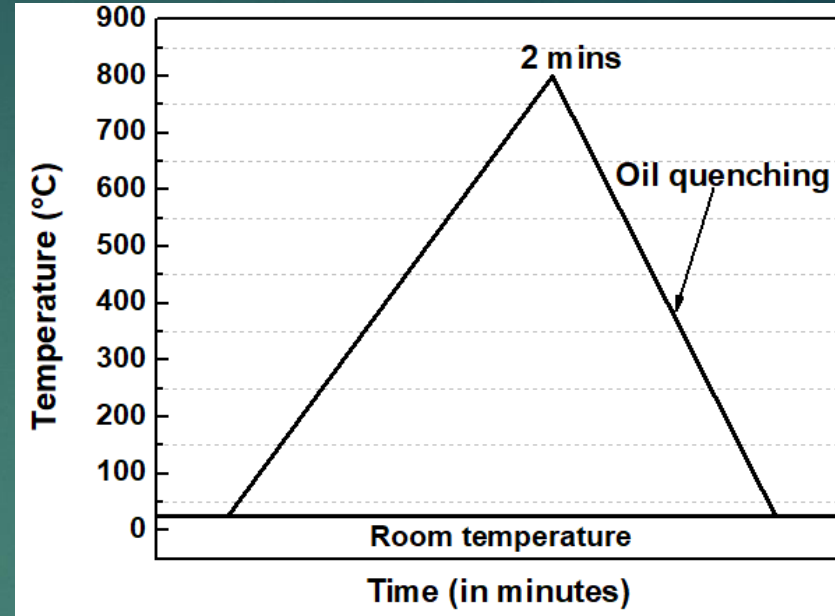
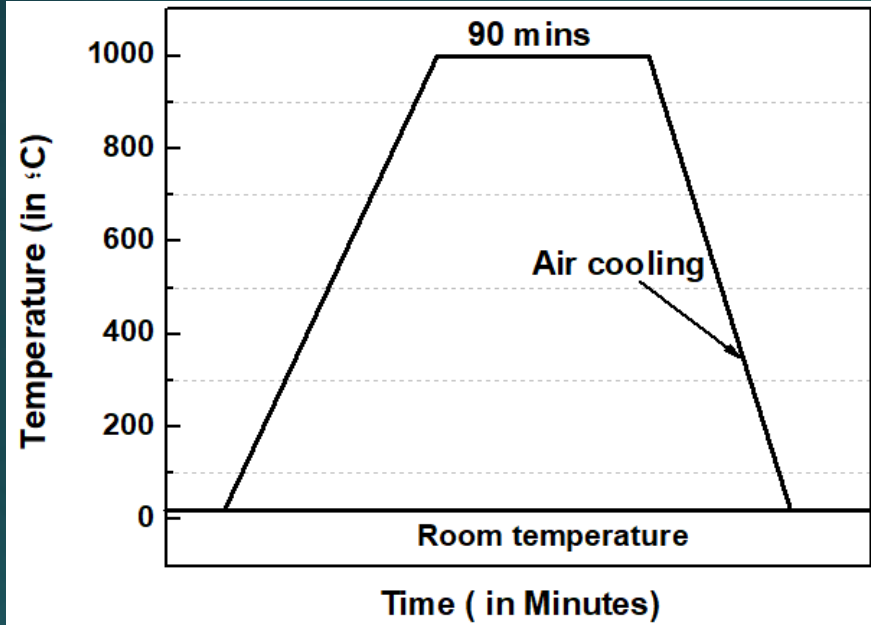
TABLE-1: The desired Mechanical properties

Composition		S.G.1	S.G.2
Elements	C	3.61%	3.45%
	Si	2.10%	2.07%
	Mn	0.20%	0.15%
	S	0.007%	0.008%
	P	0.022%	0.024%
	Cr	0.03%	0.02%
	Ni	0.047%	0.15%
	Mo	0.001%	-----
	Cu	0.009%	-----
	Mg	0.043%	0.043%
	Ce	0.004%	-----

TABLE-2 : Chemical compositions of alloys studied (in wt.%)

Specimen	Mechanical Properties			
	UTS (MPa)	0.2% YS (MPa)	%Elongation	Impact Energy (Joules)
SG-1 Normalized	691.1	245.6	11.91%	7.63
SG-1 Quenched & Tempered	1053.8	722.7	12.74%	9.17
SG-1 DMS	532.2	312.5	19.01%	14.57
SG-2 Normalized	847.9	371.2	14.29%	11.79
SG-2 Quenched & Tempered	1098	269.9	14.18%	12.77
SG-2 DMS	400.1	288.63	14.71%	14.81

TABLE-3 Mechanical Properties



Specimen ID	Ferrite Area Fraction	Tempered Martensite Area Fraction	Martensite Area Fraction	Graphite Area Fraction	Pearlite Area Fraction
SG-1 Normalized	16.5%	-----	-----	17.5%	66.0%
SG-1 Quenched & Tempered	5%	59.5%	-----	35.5%	-----
SG-1 DMS	38%	-----	42%	20%	-----
SG-2 Normalized	19.5%	-----	-----	15%	65.5%
SG-2 Quenched & Tempered	2.5%	57.5%	-----	40%	-----
SG-2 DMS	32%	-----	42%	26%	-----

TABLE-4 : Quantitative Metallographic observation(of different phases)

Specimen ID	% of Soft Phases(Ferrite+ Graphite)	Impact Energy(J)
SG-1 Normalized	34%	7.63
SG-1 Quenched & Tempered	40%	9.15
SG-1 DMS	58%	14.58
SG-2 Normalized	34.5%	11.77
SG-2 Quenched & Tempered	42.5%	12.75
SG-2 DMS	58%	14.8

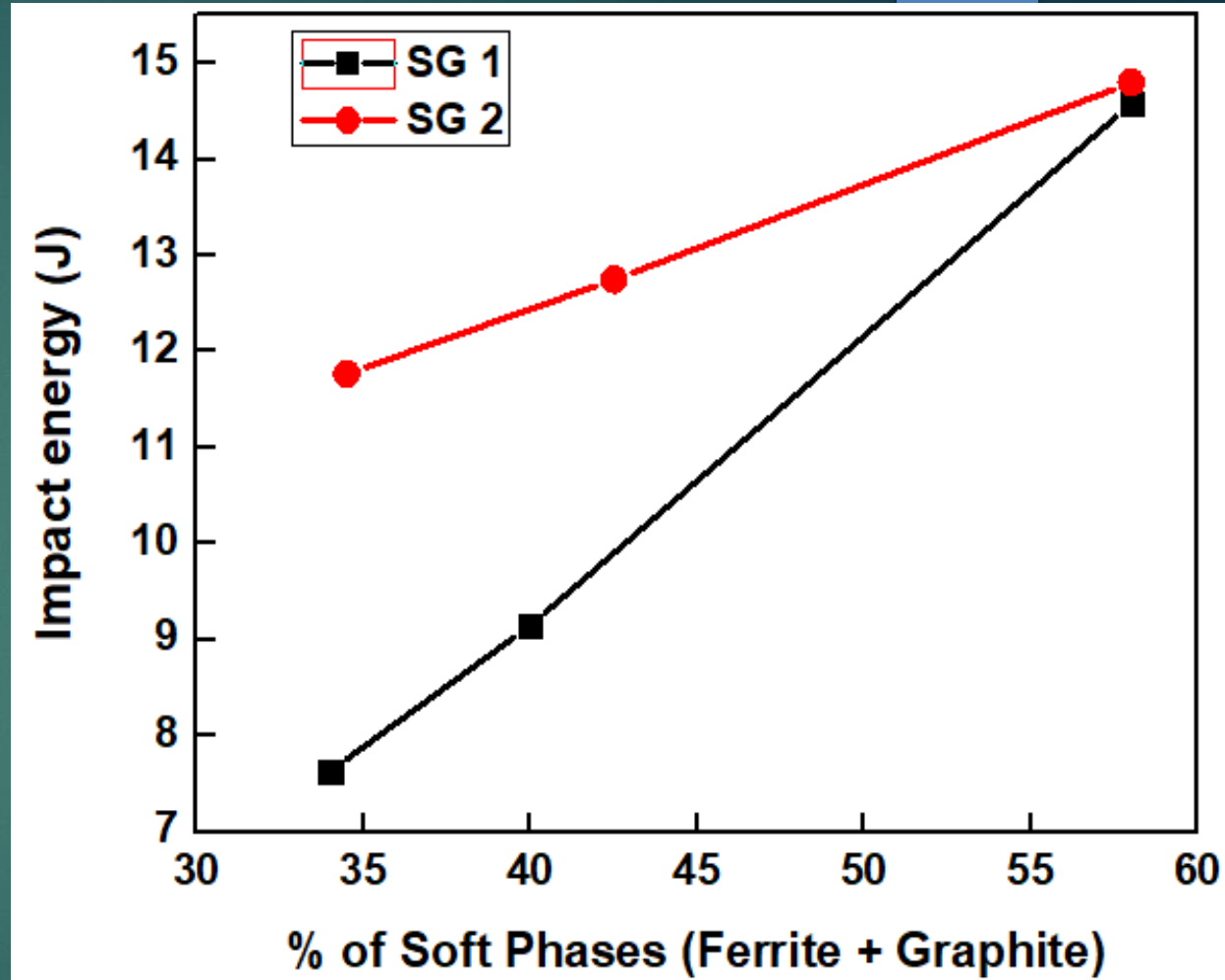
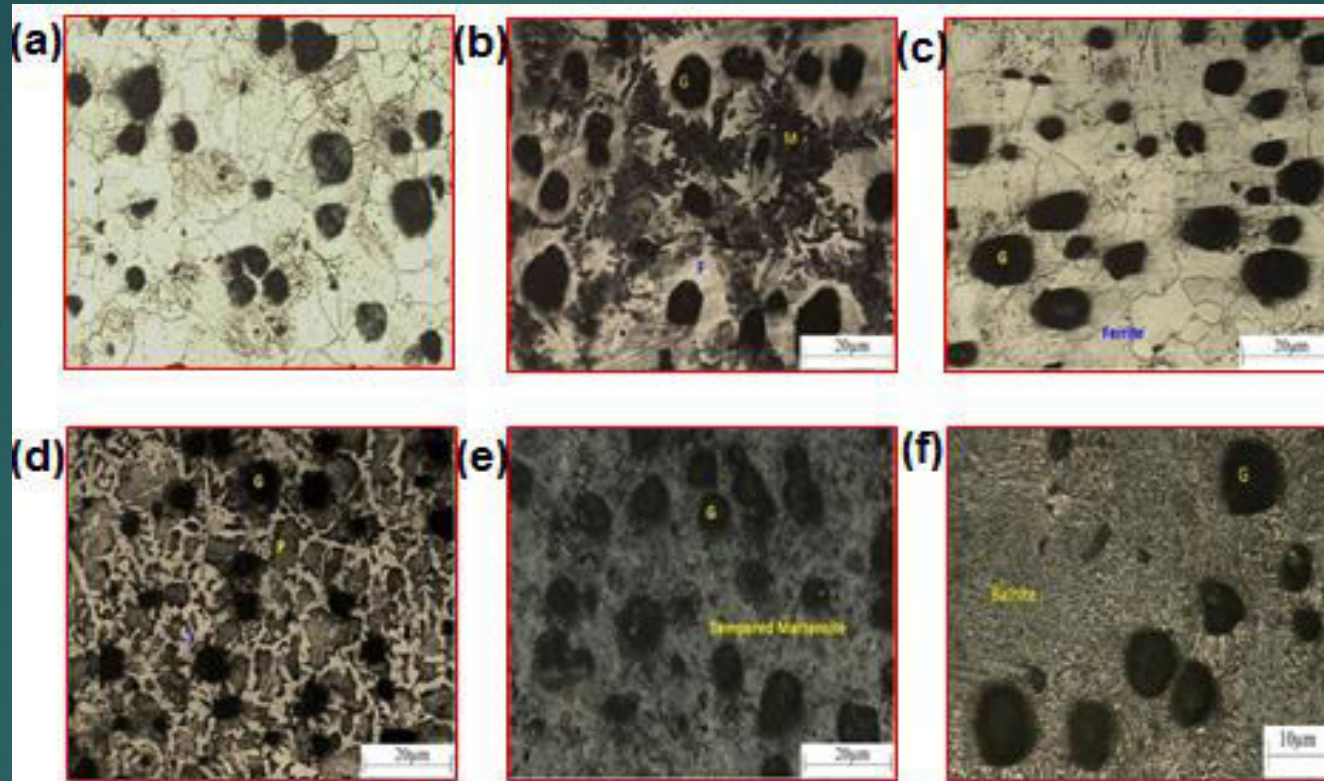


TABLE-5 : Relation between % of soft phases and Impact Energy.



Microstructures of different heat-treated samples; (a) as cast, (b) DMS (Ferrite + Martensite), (c) Annealed, (d) Normalized (Pearlitic/Ferritic), (e) Quench & Tempered and (f) Austempered (coarse upper bainitic).

CONCLUSION

