

# METALLURGY FOR PRACTITIONERS

## Virtual mode, Edition 2.0

IIM Pune chapter happy to announce second edition of short-term online refresher courses entitled as **Metallurgy for Practitioners** for the beginners / non metallurgist / working professionals. The course modules will be offered in virtual mode using digital platform for participants or those who are keen in Material Engineering domain. Participants may opt for any one or all modules and register them independently for each of the modules; certificate of participation will be awarded on successful completion of each of the module separately. Speakers are invited from relevant areas of expertise from reputed academic / industries. The course is designed to focus on fundamentals and promote interactive learning among participants.

Modules →	Heat treatment	Metallography	Material Testing
Date	10 <sup>th</sup> - 12 <sup>th</sup> Jan 2024	22 <sup>th</sup> - 23 <sup>st</sup> Jan 2024	6 <sup>th</sup> – 7 <sup>th</sup> Feb 2024
No of days	3	2	2
Last date to register	31-12-2023	31-12-2023	31-12-2023
Major subtitles in the course	Fe-C equilibrium diagram. Morphological features of phases and phase mixtures; T-T-T/C.C.T. diagrams.; Furnaces and furnace atmospheres. Temperature measurement and Calibration of thermocouples. Heat treatment cycles for common important grades, Temperature-Time selection; Heat treatment of nonferrous metals and alloys. Jominy end quench test- method Defects during Heat Treatment; extra slot for Q and A	Specimen extraction and polishing, Etchants for microstructures. Electrolytic and color metallography; Grain size measurement in ferrous and non-ferrous metals; Nonmetallic inclusions; Case depth measurement; SEM-EDS Microstructure interpretation; Image analyzer in metallography; extra slot for Q and A	Principles of Hardness on Brinell, Rockwell, Vickers Microhardness tester; Tensile test compression test and forgeability; Impact test; Bend test; Erichson cupping test; Calibration and role of NABL in material testing; extra slot for Q and A
Course fee INR including 18% GST	5000/-	4000/-	4000/-
<b>Registration: Pl send email request to <a href="mailto:office@iimpc.com">office@iimpc.com</a> (M) 9970370269</b>			
<b>The Indian Institute of Metals Pune chapter <a href="http://www.iimpc.com">www. iimpc.com</a></b>			

Dr. P. Ghosh  
Treasurer

Dr. G. Mohapatra  
Secretary

Mr. L. Pahwa  
Chairman IIMPC

## HEAT TREATMENT (HT): DAYWISE SCHEDULE (10-12 Jan 2024)

	Sessions	Lecture No.	TIME	PROGRAMME	Speaker
Fe-C equilibrium diagram	<b>Day 1 (Wednesday , 10 Jan 2024)</b>				
	Session 1		9.30-9.45	Inaugural Function	
	Session 2	1	9.45-10.30	Fe-C equilibrium diagram- meaning of equilibrium, correlation of steel microstructure with Fe-C diagram;	Prof. S. Deshmukh SCOE Pune
	Session 3	2	10.45-11.30	Heat treatment; annealed, normalized and hardened structures.	Prof. S. Deshmukh SCOE Pune
	Session 4	3	11.45-12.30	Lever rule application for phase fraction and its relevance to microstructure study, effect on hardness.	Dr. Madhu Ranjan Former VP, R and D and SS JSW Steel and former MD Elringklinger India
	Session 5	4	12.45-13.30	Effect of alloying elements and their importance in selection of parameters in heat treatment.	Dr.S.U.Dangrikar, COEPTU
Phases and phase mixtures	<b>BREAK</b>				
	Session 5	5	14.15-15.00	Identification of phases such as cementite, carbides in tool steel, carbide band in ball bearing.	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels
		6	15.15-16.00	Ferrite, pearlite, bainite, martensite. Phase banding, effect on machinability.	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels
T-T- T/C.C.T. Diagrams	Session 6	7	16.15-17.00	Process Design from a Microstructural Viewpoint	Dr Riwik Basu, KCIT
		8	17.15-18.00	Study and importance TTT /CCT diagram of important grades	Dr. S P Butee, COEPTU
Furnaces and furnace atmospheres, Calibration	<b>Day 2 (Thursday , 11 Jan 2024)</b>				
	Session 7	9	9.30-10.15	Various atmospheric heat treatment process, and the equipment used; Various Vacuum heat treatment and the equipment used	Deepak Kulkarni, Consultant
		10	10.30-11.15	Devices, Primary and Secondary calibration methods (E220, E230)	Mangesh Rajhans, Consultant
11		11.30-12.15	Use of Optical radiation pyrometer (E639); CQ9	Mangesh Rajhans, Consultant	
HT cycles	Session 8	12	12.30-13.15	Austenitisation temperature selection for various steel grades, basis of calculation, empirical formulae	Dr P Ghosh, CME
	<b>BREAK</b>				
Hardening and tempering of steels	Session 9	14	15.00-15.45	Meaning of hardening, Quenching media - oil, polymeric solution, severity of quench, microstructures, hardness,	Dr. S P Butee, COEPTU
		15	16.00-16.45	Microstructural changes during tempering, single tempering and double tempering. Temper embrittlement	Dr. S P Butee, COEPTU
HT of Tool Steel	Session 10	16	17.00-17.45	Hardening and salt bath treatment	Dr N B Dhokey, COEPTU
		17	18.00-18.45	Multiple tempering; microstructure and hardness, applications to dies and tooling	Dr N B Dhokey, COEPTU
HT of stainless steel	<b>Day 3 (Friday , 12 Jan 2024)</b>				
	Session 11	18	9.45-10.30	Solutionising and ageing/ tempering;	Dr K Kambale, COEPTU
19		10.45-11.30	Heat response to stainless steel; 17-4PH S.S.	Dr K Kambale, COEPTU	
HT of nonferrous metals and	Session 12	20	11.45-12.15	Prominent alloys of nonferrous. Al, Cu, Mg and Ti	Dr.S.U.Dangrikar, COEPTU
		21	12.30-13.15	Solution treatment, ageing ; structure-property relation;	Dr.S.U.Dangrikar, COEPTU
Jominy end quench test	<b>BREAK</b>				
	Session 13	22	14.00-14.45	Physical significance of hardenability, Reporting of values (ASTM A255), relevance of test in selection of rolled section or in respect of gear or any automotive components (ASM handbook).	Mangesh Rajhans, Consultant
Defects during Heat Treatment	Session 14	23	15.00-15.45	Defects such as distortion, cracks etc.– Causes and Remedies;	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels
		24	16.00-16.45	Sponsors lecture	To decide

\*\* Question and answer time of 15 minutes is reserved after each session

## METALLOGRAPHY: DAYWISE SCHEDULE (22-23 Jan 2024)

Specimen extraction and polishing.	Sessions	Lecture No.	TIME	PROGRAMME	Speaker
	<b>Day 1 (Monday, 22 Jan 2024)</b>				
Etchants and Metallography	Session 1		10.00-10.15	Inaugural Function	
	Session 2	1	10.15-11.00	Different specimen extraction machines; Practice for preparing specimen (ASTM E3) and interpretation of structures.	Dr. S P Butee, COEPTU
2		11.15-12.00	Safety, maintenance and economical aspect of consumables required for polishing viz. emery paper, diamond paste, alumina suspension, Microscopes etc.	Dr. S P Butee, COEPTU	
Grain size measurement	Session 3	3	12.15-13.00	Practice for preparing etching solutions (ASTM E407). Other literature sources (ASM handbook.)	Dr.S.U.Dangrikar, COEPTU
	<b>BREAK</b>				
Non-metallic inclusions	Session 4	4	14.00-14.45	Operating principle of Electrolytic polishing. Colour metallography of ferrous and nonferrous materials	Dr.S.U.Dangrikar, COEPTU
	Session 5	5	15.00-15.45	Prior treatments, factors affecting grain size, Method of grain size assessment, its relevance to mechanical properties, response to heat treatment,	Dr. Madhu Ranjan Former VP, R and D and SS JSW Steel and former MD Elringklinger India
6		16.00-16.45	Significance and manifestation of grain size, significance of austenite grain size. (IS 4748, ASTM E112), quantitative methods (Jeffry's , Line intercept)	Dr P Ghosh, CME	
<b>Day 2 (Tuesday, 23 Jan 2024)</b>					
Case depth measurement	Session 1	7	10.00-10.45	ASTM E45 charts. Morphological features of inclusions, sources of inclusions -endogenous and exogenous;	Dr. N B Dhokey, COEPTU
		8	11.00-11.45	DIN1502 method; Blue fracture test, step down test to assess micro-inclusions	Dr. N B Dhokey, COEPTU
SEM- EDS and Image Analyzer	Session 2	9	12.00-12.45	Specimen extraction method; microstructural features; Carburised, nitrided, plasma nitrided	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels
	<b>BREAK</b>				
SEM- EDS and Image Analyzer	Session 3	10	13.45-14.30	Induction hardened etc., Correlation with microhardness traverse. Relevant standard ASTM...	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels
	Session 4	11	14.45-15.30	Interperion of Microstructures; Fracture topography	Dr N B Dhokey, COEPTU
SEM- EDS and Image Analyzer	Session 5	12	15.45-16.30	Online demo of Application of software in quantitative analysis of phases, fraction etc. Determination of grain/particle size, phase count, nodularity	Sponsors to decide
		13	16.45-17.30	Case depth, statistical approach etc. Microstructure of ferrous and nonferrous alloys	Sponsors to decide

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## MATERIAL TESTING: DAYWISE SCHEDULE (5-6 Feb 2024)

	Sessions	Lecture No.	TIME	PROGRAMME	Speaker
Principles of Hardness	<b>Day 1 (Monday, 5 Feb 2024)</b>				
	Session 1		10.00-10.15	Inaugural Function	
	Session 2	1	10.15-11.00	Specimen preparation; Hardness Measurement and types (ASTM E10, E92, E18, E384,A833 etc.)	Dr V T Thavale, COEPTU
		2	11.15-12.00	Significance of indentation spacing and surface finish, Selection of hardness tester and appropriate scale,	Dr. Madhu Ranjan Former VP, R and D and SS JSW Steel and former MD Elringklinger India
	Session 3	3	12.15-13.00	Hardness Conversion and Correlations (E140), Calibration, Case depth determination & study of welded structure with microhardness traverse.	Dr. Madhu Ranjan Former VP, R and D and SS JSW Steel and former MD Elringklinger India
Tensile test	<b>BREAK</b>				
	Session 4	4	14.00-14.45	Specimen selection, preparation and its dimensions, Determination of 0.2% proof stress.	Dr S P Butee, COEPTU
	Session 5	5	15.00-15.45	Interpretation of data, international standards, effect of gauge length, Poisson ratio. Youngs modulus	Dr S P Butee, COEPTU
6		16.00-16.45	Specimen shapes and dimensions	Dr S.B. Sarkar, Former Sr VP Mahindra Sano Spl Steels	
Compression test and forgeability	<b>Day 2 (Tuesday, 6 Feb 2024)</b>				
	Session 1	7	10.00-10.45	Significance of notch, Low temperature testing, impact transition temp., Izod and polymer impact tester, specimen dimensions, (ASTME 23)	Dr P Ghosh, CME
	Bend test	8	11.00-11.45	Important parameters such as tip radius, bend angle its significance, Types of bend test, , Interpretation of data applications (ASTM E 290)	Dr V T Thavale, COEPTU
Session 2		9	12.00-12.45	Determination of formability and its role in selection of material, type of steel specification desired (ED, DD), normally high aluminum.	Dr. K Kambale, COEPTU
Erichson cupping test	<b>BREAK</b>				
	Session 3	10	13.45-14.30	Determination of formability and its role in selection of material, type of steel specification desired (ED, DD), normally high aluminum.	Dr. K Kambale, COEPTU
Calibration and role of NABL in testing	Session 4	11	14.45-15.30	Selected test apparatus as illustrated in course content and importance of calibration	Shrikant Kulkarni, LA, NABL
	Session 5	12	15.45-16.30	Relevant standards and regulatory bodies like NABL	Shrikant Kulkarni, LA, NABL

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\*\*Note: Schedule for all the programs is tentative.