



Course Syllabus

Department/Faculty School of Engineering
Graduate Program Materials Engineering and Nanotechnology
Degree <input checked="" type="checkbox"/> Academic Master's <input checked="" type="checkbox"/> Doctorate (PhD) <input type="checkbox"/> Professional Master's
Course Name Heat Treating Technology
Professor(s)
Office hours 48
Course Overview <p>Steels microstructure definition. Isothermal and continuous cooling curves. Hardenability tests. Effect of alloying elements. Tempering reactions; Heat treating definitions. Thermochemical treatments. Heat treating Industrial Equipment's. Heat treatment effect on the residual stresses and dimensional Stability. Failures related to heat treatment. The effect of base material choice, mechanical design and manufacturing processes on the heat treatment components response.</p>
Program content: 1 - Definition of microstructure of steels: Ferrite; Pearlite; Fe-C diagram; Upper Bainite; Lower Bainite; Martensite medium low and high carbon. 2 - Isothermal and continuous cooling curves; Hardenability measurements; Tempering reactions; Effect of alloying elements. 3-Heat Treatments: Overview of annealing processes; Normalizing; Coalescing anneal; Quenching; Tempering. 4 - Thermochemical treatments (Carburizing, Carbonitriding, Borodazing, Salt Plasma and Gas Nitriding). 5 - Industrial Equipment. 6 - Heat treatment effect on residual stresses and dimensional stability. 7 - Typical failures related to heat treatment operations.
Letter Grade Assignment Grade A (Excellent) - Grade points between 9 and 10 Grade B (Good) - Grade points between 8 and 8.9 Grade C (Satisfactory) - Grade points between 7 and 7.9 Grade D (Unsatisfactory) - Grade points between 0 and 6.9



Texts, Materials, and supplies

ABRAMOVICI, E.; NORTHWOOD, D. O.; SHEHATA, M. T.; WYLIE, J. (ED.).

Microstructural Science: Analysis of In-Service Failures and Advances in Microstructural Characterization. 26th ed. USA: ASM, 1999. v. 26.

BROOKS, C. R. **Principles of the Heat Treatment of Plain Carbon and Low Alloy Steels.** USA: ASM International, 1996.

HAZOTE, A. **Solid State Transformations and Heat Treatment.** New York: John Wiley & Sons, 2005.

HONEYCOMBE, R. W. K.; BHADESHIA, H. K. D. H. **Microestrutura and Properties.** London: Halted Press, 1996.

ROBERTS, G; KRAUSS, G.; KENNEDY, R. **Tool steels.** 5th. ed. USA: ASM International, 1998.

THE MATERIALS INFORMATION SOCIETY. **Heat Treater's Guide: practices and procedures for irons and steels.** 2nd. ed. USA, 1995.

TOTTEN, G. E. **Steel Heat Treatment Handbook.** New York: CRC Press, 2006.

VOORT, G.F.V. (Ed.). **Handbook: Metallography and Microstructures.** USA: ASM, 2004. v.9.

CANALE, L. C.F.; VATAVUK,J.; TOTTEN, G. E.; LUO, X. **Problems Associated with Heat Treating. Steel Heat Treating Technologies. Vol. 4B.** USA: ASM Habdbook Volumes on Heat Treating, 2014. ASM INTERNATIONAL. Heat Treating Society.

NEVES, R.; CANALE, L. C.F.; VATAVUK,J.; LAMPMAN, S. **Tempering of Steels. Vol. 4A.** USA: ASM Habdbook Volumes on Heat Treating, 2013. ASM INTERNATIONAL. Heat Treating Society.

CANALE, L. C.F.; VATAVUK,J.; TOTTEN, G. E. **Martempering of Steels. Vol. 4A.** USA: ASM Habdbook Volumes on Heat Treating, 2013. ASM INTERNATIONAL. Heat Treating Society.

CANALE, L. C.F.; VATAVUK,J.; TOTTEN, G. E. **Introduction to Steel Heat Treatment.** Comprehensive Materials Processing. Vol. 13, p 3-37. 2014. Elsevier New York.