

Heat Treat and Metal Education Opportunities

AGMA and ASM International offer a diverse range of steel, metallurgy and heat treat courses both in-person and virtually in 2021. Education and training in these areas are still one of the greatest challenges in manufacturing. Please note that both AGMA and ASM International will have a variety of educational programs in St. Louis during Motion + Power Technology Expo and the co-located Heat Treat from September 14–16 (motionpowerexpo.com, Home - Heat Treat (asminternational.org))

AGMA Steels for Gear Application

This virtual course takes place June 15–16.

Attendees will gain a basic understanding of steel and its properties. Learn to make use of steel properties in an application and understand the potential that different steel and heat treatment options can offer. Explore how performance of the material depends on how the steel is produced. The course is intended to support gear engineers, gear designers, material specialists or metallurgists at OEMs, Tier 1s, Tier 2s, etc., production engineers, technicians and managers. A webcam on your computer

equipped with a microphone and speakers/headset are required for participation in this virtual course. Space is limited to 20 participants per course. Course materials will be mailed in hard copy.

Objectives include:

- Describe how material properties are affected by steel quality and heat treatment.
- Describe how stresses are introduced by heat treatment process and surface modification treatments.
- Explain how to select a steel and heat treatment combination to meet the demands of the application.
- Review influence of material selection on the manufacturing of components.
- Discuss how to verify and specify required steel properties.

www.agma.org/education/advanced-courses/2021-steels-for-gear-application/

AGMA Operator Precision Gear Grinding

This course takes place September 28–29, 2021 at Daley College in Chicago.

Attendees will explore gear grinding processes, machine kinematics and setup, pitfalls, failures and expectations related to finish ground gearing. Learn definitions of gearing component features, process steps from blanking,

through heat treatment to finished part ready to ship. Study aspects of Quality Assurance, Inspection Documentation and corrective actions for measured non-conformances. Understand pre-heat treat, heat treatment and post heat treatment operations including the how's and why's to produce finished gears that conform and perform to end user expectations. This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel. Class will take place 8:00am–5:00pm each day.

Objectives include:

- Review and challenge control of part datums for pre-heat treatment operations, use datum's consistently through



finishing operations given part prints.

- Anticipate and correct for part distortion during heat treatment knowing the actual heat treatment process used.
- Understand gear grinding kinematics for both form and generating machines along with allowable metal removal rates and wheel dressing intervals based on type of grinding wheels being used.
- Ask questions of gear designers and manufacturing engineers to acquire all information required to produce conforming finished gears.
- Accurately apply and inspect pre-calculated micro-geometry modifications derived from complex contact analysis software.
- Perform component finishing machine setup, alignments, component inspection and calibrations to established ISO standards with hands on lab if available, or, run calculations on grinding cycle times based on various target accuracies and grinding techniques.
- Select the optimum grinding wheel specification given part print and heat treatment used.
- Achieve compliance with finished

parts to meet print requirements and customer performance expectations.

- Accurately measure pre and post finish gear tooth thickness given finished tooth thickness specifications.
- Avoid and detect the presence of Twist Error.
- Avoid and detect presence of grind burn temper.
- Avoid typical gear fatigue failure modes resulting from improper finishing.
- Identify common non-conformances, apply problem solving techniques and corrective actions.

www.agma.org/education/advanced-courses/2021-operator-precision-gear-grinding/

AGMA Gear Heat Treatment Operator/Operations

This course takes place November 9–10, 2021 at Daley College in Chicago.

This course provides the heat treat operator and operations team, the means to perform the heat treatment of steel gears in a manner that meets the AGMA and customer requirements in a safe and efficient manner. The course identifies the key requirements for proper

processing. Sufficient metallurgical background is provided to allow the student to identify how this information relates to the required processing and properties of the gear. This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel. Class will take place 8:00am–5:00pm each day.

Objectives include:

- Identify and locate the required information for material, process, and equipment for gear heat treatment.
- Recognize how the various heat treatment processes apply to the relevant AGMA documents.
- Perform preparation to product and equipment for heat treatment in an efficient and safe manner.
- Operate and monitor heat treat equipment and perform quality control processes.
- Perform post-heat treatment processes, Go/No-Go material inspections and cycle documentation reviews.

www.agma.org/education/advanced-courses/2021-heat-treatment-equipment-operator/



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ASM International Basics of Heat Treating

This virtual course takes place July 26–28, 2021.

Heat treating is considered the least understood, but most integral part of the manufacturing processes. An efficient heat treating process reduces the overall manufacturing costs associated with energy use, scrap, re-work, and quality issues. Heat treating is critical for your business and industry.

The Basics of Heat Treating course provides an interactive approach to learning the basic elements associated with the heat treating of metals. The course includes a variety of real-life manufacturing situations for discussion. There is also an interactive question and answer sessions integrated throughout the course.

Objectives include:

- Explain the importance and application of the Iron cementite diagram (iron carbon equilibrium Diagram) and its application.
- Describe the Time Temperature Transformation diagram and its influence on phase transformations and microstructure.
- Predict the mechanical properties and microstructures resulting from heat treatment initiated by thermal transformation.
- Identify and solve heat treat problems using the material, atmosphere, time, and temperature (M.A.T.T.) procedure demonstrated in class.

www.asminternational.org/learning/courses/online/-/journal_content/56/10192/27395478/CLASS

ASM Component Failure Analysis Online Course

This online course focuses on the practical materials and processing knowledge necessary to perform failure analysis on these widely used component groups. The course materials and instruction will provide insight into the manufacturing of components, circumstances resulting in degradation, and diagnostic features for failure analysis and prevention. Half day component sections include shafts and bearings; mechanical fasteners; cast and wrought materials; welded, brazed and soldered joints; gears; boilers and heat exchangers; and pressure vessels. Engineers and



technicians involved in the maintenance, failure analysis and failure prevention of components will benefit from the course. General knowledge of materials and some background in failure analysis principles would be helpful but not mandatory. ASM courses in principles of failure analysis would be good preparation for the detailed treatment of each of the component types covered, but are not mandatory.

Objectives include:

- Understand normal failure modes for the different types of components.
- Identify the fabrication factors and service characteristics that can lead to those failure modes.
- Participate in or help plan failure analysis investigations of these components.
- Interpret failure analysis conclusions in order to help identify preventative action.

www.asminternational.org/learning/courses/online/-/journal_content/56/10192/40217544/CLASS

ASM Case Hardening of Steel — Digital Course

This digital course examines case hardening as an important part of heat treating. It is particularly useful for the manufacture of machine parts, carbon steel forgings and carbon steel pinions.

In many metallurgical applications, strength is of minor importance and wear resistance is the major consideration. In other applications where wear

resistance is still the prime consideration, a high level of strength and considerable toughness are also required. To produce these conditions, it is necessary to employ specialized techniques that result in a relatively thin surface layer of the steel being space hardened. This thin layer is termed the case and the technique to produce the layer is termed case hardening. In this self-guided digital course, students will learn — with the help of rich visuals, narrated animations, and interactive quizzes — the different case hardening processes including carburizing, carbonitriding, and nitriding; quenching of case hardened parts; induction hardening; and the various types of furnaces used in commercial heat treating processes.

Objectives include:

- List the reasons for case hardening.
- Outline the advantages of carburizing, carbonitriding, nitriding, and induction surface hardening.
- Describe in general the operation of batch-type and continuous furnaces.
- Compare surface hardening by induction to other processes.
- Give the reasons for quenching of case-hardened parts.
- Differentiate between effective case depth and total case depth.

www.asminternational.org/learning/courses/online/-/journal_content/56/10192/37494537/CLASS