

Course Description

The modern production of steel has evolved over many centuries, with many technological improvements during the last 25 years. The making, shaping and treating of steel are critical to product design, application, cost and performance. It is essential that employees involved in producing iron and steel, operating rolling mills, supplying equipment and materials to the steel industry, designing products, engineering, sales, and construction have an understanding of what steel is, how it is produced, and the effects of making, shaping and treatment on the final performance of steel products. This course provides essential knowledge to those who do not have a technical background in metallurgical engineering, rolling or quality-added downstream processing but have a need to understand more about the technical aspects of steel manufacturing, properties and applications.

Who Should Attend

Iron and steel industry production workers and supervisors, equipment and materials suppliers to the steel industry, steel marketing and sales personnel, machine shop personnel, quality control technicians and supervisors, and component designers and engineers.

Registration Fees

Advance registration by 12 September 2023: Member US\$845, Non-member US\$1,090. Registration after 12 September 2023: Member US\$945, Non-member US\$1,190. Registration fees include Tuesday and Wednesday breakfast and lunch; Tuesday reception; plant tour with bus transportation; choice of *The Making, Shaping, and Treating of Steel*® CD-ROMs, which include one of the following volumes from the 11th edition: *Ironmaking, Steelmaking/Refining, Casting, Flat Products and Long Products*; and a course workbook or flash drive including presentations.

Hotel Accommodations

A block of rooms has been reserved at the Embassy Suites by Hilton Columbia. Please call the hotel at +1.803.744.8132 by 2 October 2023 and mention group code AIS to secure the AIST discount rate of US\$124 per night for single/double occupancy.

Professional Development Hours

This course may qualify for up to 11.25 Professional Development Hour (PDH) credits. Each attendee will receive a certificate listing the quantity of PDH credits earned for the course. This course is not approved for PDH credits in New York, Florida, North Carolina and Oklahoma.

Attention Non-Members

Non-member registration fees include membership in AIST through 31 December 2024. Membership is not automatic. A completed membership application must be returned to AIST.

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AIST Members
US\$845 Before 12 September
US\$945 After 12 September

Non-Members
US\$1,090 Before 12 September
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The Making, Shaping and Treating of Steel: 101

24-25 October 2023

Embassy Suites by Hilton Columbia
Columbia, S.C., USA

Plant Tour: CMC Steel South Carolina

AIST.org

Instructors



Frank Fonner

Former Director of Quality and Metallurgical Engineering, NLMK USA, Farrell, Pa., USA

Fonner began his career in the steel industry in July 1981 and retired in June 2021, after a 40-year career in the steel industry. He joined then-Jones & Laughlin Steel Corp. in Aliquippa, Pa., USA, after earning his B.S. degree in metallurgy from The Pennsylvania State University in 1981. He worked for J&L Steel (subsequently LTV Steel) for 13 years, holding quality, maintenance and operating positions in the Tin Plate Department at the Aliquippa Works. In 1994, he joined the Association of Iron and Steel Engineers, where he became the editor-in-chief of *Iron and Steel Engineer*. In 2003, he joined Duferco Farrell Corp. as manager of process and product quality. In 2010, Duferco Farrell was acquired by NLMK of Lipetsk, Russia, and NLMK USA was formed by joining the Duferco Farrell plant with the Beta Steel plant in Portage, Ind. He earned an M.B.A. from the Katz Graduate School of Business at the University of Pittsburgh in 1987.



Bryan Webler

Associate Professor, Materials Science and Engineering Department, Carnegie Mellon University, Pittsburgh, Pa., USA

Webler is a faculty member in the Center for Iron and Steelmaking Research at Carnegie Mellon University (CMU). He received a B.S. degree in engineering physics from the University of Pittsburgh in 2005 and an M.S. degree (2007) and Ph.D. (2008) in materials science and engineering from CMU. From 2008 to 2013, he was a senior engineer in the Materials Technology Department of the Bettis Atomic Power Laboratory. Webler joined CMU in 2013. His research interests are primarily in the reactions between steels and their environments, both during processing and in service. Webler is involved in projects studying inclusion evolution during steel processing, high-temperature oxidation of steels and other alloys, corrosion of stainless steels, and microstructure evolution during additive manufacturing of steels. He also teaches classes on computational thermodynamics and corrosion of metals. He received the Kent D. Peaslee Junior Faculty Award from the AIST Foundation in 2015 and was named an AIST Steel Professor in 2019.

Schedule

Tuesday, 24 October 2023

- 7 a.m. **Breakfast and Registration**
- 8 a.m. **Overview of the Making, Shaping and Treating of Steel and History of the Industry**
The first session provides an overview of the technologies used to produce steel today and the evolution of world steel production. The general chemistry of steel is introduced to help illuminate the principles of iron- and steelmaking. This session ends with a brief history of metals production and an introduction to early iron- and steelmaking processes.
- 9 a.m. **Break**
- 9:15 a.m. **Ironmaking and Steelmaking**
This session explains the techniques used to produce iron and steel from raw materials, including ores and recycled materials. Processes reviewed include the blast furnace, direct reduction, ferrous scrap production, basic oxygen steelmaking and electric furnace steelmaking. Important gas, slag and metal reactions will be explained, as well as the impacts of the processes on energy and the environment. The effects of the different processing techniques will be explained, and future iron- and steelmaking developments will be explored.
- 10:45 a.m. **Break**
- 11 a.m. **Secondary Metallurgy**
Basic, acid, and neutral slags and refractories will be introduced, along with reasons for using each. The interaction of refractories and slags with metal will be explored, including methods of reducing refractory wear and quality improvements. The use of ladle metallurgy treatment and furnaces will be explained. The principles behind other secondary steelmaking techniques will be explained, including degassers and argon oxygen decarburization steelmaking for the production of high-quality steels such as ultralow-carbon and stainless steels. Inclusion formation, modification and removal will be discussed.
- Noon **Lunch and Plant Tour of CMC Steel South Carolina** 🏭
- 5-6 p.m. **Reception**

Wednesday, 25 October 2023

- 7 a.m. **Breakfast**
- 8 a.m. **Solidification Fundamentals and Batch Casting**
The importance of solidification on final product quality will be discussed. The effects of tundish and mold metallurgy on product quality will be explained, along with casting defect causes and methods of prevention.

- 8:45 a.m. **Break**
- 9 a.m. **Continuous Casting of Steel**
The history and evolution of continuous casting processes from billets, blooms, and slabs to near-net-shape processes for thin slabs, strip, beam blanks and wire will be reviewed.
- 10 a.m. **Break**
- 10:15 a.m. **Introduction to Product and Physical Metallurgy**
The various end products of steel manufacturing will be introduced. The requirements and methods to produce these products will be reviewed.
- Noon **Lunch**
- 1 p.m. **Hot Rolling and Cold Rolling Process Operations**
This section will provide an introduction to the theory of rolling and the effects of deformation processing on product quality and properties. The importance of the reheating process and how it affects subsequent rolling and quality will be discussed. Billets and blooms will also be reviewed.
- 3 p.m. **Break**
- 3:15 p.m. **Downstream Processing — Galvanizing and Galvanneal**
Steel finishing techniques, including heat treating and coating, will be reviewed. Basic steel heat treatment concepts of quenching, tempering, case hardening and in-process annealing will be introduced, along with the effects they have on steel microstructure and properties. Surface coating techniques, including galvanizing and other coatings, will be discussed.
- 4 p.m. **Physical Testing of Steels — Types, Mechanical Properties and Consistency**
Characteristics, applications and mechanical properties of steel alloys and grades will be explored. The effects of different alloying elements on steel manufacturing and final properties will be explained. An introduction of the methods of testing the properties of steel — including tensile, toughness and fatigue testing — will lead into discussions of the importance of melting, casting, rolling and forming on the final mechanical properties. The importance of selecting alloys and processing routes for specific engineering applications to achieve desired properties will be explained.
- 5 p.m. **Conference Adjourn**



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