International VDEh-Seminar

Continuous Casting of Steel

Practical and Scientific Approaches

August 27th to August 30th 2018
Cologne, Germany

**AIM**

Steel is the no. 1 material in the world of technology. Automobiles, machines and countless parts of daily life are made of steel. New and innovative high performance steel grades are created and combine several properties on a high level of quality. Plant design and casting processes are continuously developed. At present, independent of the production route and resources more than 95% of the raw steel melts are cast continuously. The metal solidifies in the shape of slabs, blooms or billets. During the casting step the quality of the later product is determined, as well as the surface as in inner regions. Product properties like strength, elongation, fatigue behaviour or optical surface appearance have their origin in controlled solidification.

This Continuous Casting Course is designed to train persons in continuous casting of steel. In half a week the essential topics of CC are explained in detail. The lectures are supplemented by exercises to intensify learning. The course is suitable to give an overview to newcomers and to train operating engineers in theoretical fundamentals. Also within the group many possibilities of fruitful discussions are given and realised.

*Note: Both during lectures and discussions, as well as in the breaks of the seminar, our guidelines on adherence to cartel-law regulations shall be followed.*

**REGISTRATION FEE**

EUR 1.470,- EUR 1.190 registration fee VAT-free
+ EUR 280 conference package

EUR 1.270,- EUR 990* registration fee VAT-free
+ EUR 280 conference package

* for employees of member companies and individual members of the Steel Institute VDEh, and for scientific staff of universities

The conference package includes food and beverages during the seminar (incl. 19% VAT).

A free withdrawal from the seminar is possible until 2 weeks prior to the start. Then, 25% of the seminar fee must be paid. The total registration amount will be charged for no show or cancellation from the first day of the event. The participant also has to bear the cancellation costs of the seminar hotel.

**CONTENT**

- Fundamentals on Steel Solidification
- Heat Transfer in Continuous Casting
- Cooling Systems
- Shell Growth
- Development of Real Solidification Structures
- Fluid Flow in Mold and SEN
- Strand Guiding; Mechanical Stress and Strain
- Performance of Casting Flux in the Mold
- Surface Defects
- Crack Formation
- Coupling of Casting and Hot Rolling
- Refractory Materials

**CHAIRMEN**

Professor Dr.-Ing. Dr. h.c. Dieter Senk

**REGISTRATION**

Stahl-Akademie • Stahlinstitut VDEh
Sohnstraße 65 • 40237 Düsseldorf
Fon +49 (0)211 6707-458 • Fax -655
info@stahl-akademie.de, www.stahl-akademie.de

**VENUE / HOTEL**

art’otel Cologne
Holzmarkt 4, 50676 Cologne, GERMANY
Tel +49 221 80103-0, www.artotels.com

Once we have confirmed your place on the seminar the Steel Academy will automatically make a room booking for the participants at the art’otel Cologne from 27th August to 30th August 2018 for a special rate of EUR 101 / night incl. breakfast. The hotel room bill will be settled by you upon departure. Please advise at your registration, if you do not need a reservation or whether you would like to stay longer in the hotel.
PROGRAMME

Monday, 27th August 2018

14:00 Introduction to Course
   Personal introduction of lecturers and participants • Introduction to Cologne

14:30 Crash Course: Fundamentals on Steel Solidification
   Author and Speaker: Prof. Senk
   Crystalization • Components, phases, equilibrium • Phase diagrams • Eutectic and peritectic solidification modes • Inclusions and precipitates • Heat content

16:00 Coffee Break

16:30 Heat Transfer in Continuous Casting
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke
   Heat withdrawal in the mold and secondary cooling zone • Modeling of heat flow in CC • Thermal tracking

18:00 Exercises on Heath Withdrawal
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke

19:00 Dinner

Tuesday, 28th August 2018

08:30 Technology of CC; Cooling Systems
   Author: Prof. Senk, Speaker: Dr. Wans
   Development of CC • Products • Plant types • Technical components of casting machines • Primary and secondary cooling systems for solidifying strands

10:30 Coffee Break

11:00 Shell Growth in Continuous Casting
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke
   Plant data on shell growth • Non-uniformity of heat transfer and shell growth

12:30 Lunch

13:30 Development of Real Solidification Structures
   Author and Speaker: Prof. Senk
   Nucleation • Crystals growth • Micro-segregation • Formation of precipitates • Columnar and equiaxed dendritic structures, CET • Influence of superheat, electromagnetic stirring, cooling intensity and soft reduction • Core solidification • Macro-segregation

15:30 Coffee Break

16:00 Strand mechanics
   Author and Speaker: Prof. Tacke
   Bulging, straightening, bending, thermal stresses • Mechanical loads • Risks of internal and surface cracking

17:30 Teamwork on CC Process Design
   Prof. Senk, Prof. Tacke

19:00 Dinner

Wednesday, 29th August 2018

8:00 Steel Plant Tour: Bus Departure to HKM, Duisburg
   Visit of the continuous casting section of HKM: Round billet and bloom casters, slab casters incl. low head machine and twin mold caster • Strand cooling areas

13:00 Lunch

14:00 Fluid Flow in Mold and SEN
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke
   Flow pattern of steel in the mold • Meniscus fluctuations • Modification of fluid flow by electromagnetic stirring and braking • Fluid flow in the SEN

16:00 Coffee Break

16:30 Performance of Casting Flux in the Mold
   Author: Prof. Schwerdtfeger, Speaker: Prof. Senk
   Performance in the mold • Principles of powder selection

18:00 Exercises on Casting Flux
   Author: Prof. Schwerdtfeger, Speaker: Prof. Senk

19:00 Dinner

Thursday, 30th August 2018

8:30 Refractory Materials in Continuous Casting
   Author and Speaker: Prof. Senk

9:00 Crack Formation in Continuous Casting
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke
   Surface cracks • Fine surface or subsurface cracks • Internal cracks

10:15 Coffee Break

10:45 Coupling of Casting and Hot Rolling
   Author: Prof. Senk, Speaker: Dr. Wans
   Cutting production chains • Product range • Thin slab casting and inline hot rolling

12:00 Lunch

13:00 Surface Defects other than Cracks and Regular Oscillation Marks. Slabs, Blooms and Billets
   Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke
   Bleeds • Laps • Depressions • Non-normal oscillation marks • Surface carburization • Surface inclusions and slag spots • Holes • Blisters and slivers

14:00 Round Table Discussion
   Prof. Senk

14:45 Summary

15:00 End of the Seminar

SPEAKERS:

University Professor Dr.-Ing. Klaus Schwerdtfeger worked a lifetime in the field of metallurgy, particularly in metallurgy of solidification. After leading the Metallurgical Dept. of Max-Planck-Institute at Düsseldorf he chaired the Dept. of General Metallurgy at TU Clausthal University. Now he works as a consultant.

University Professor Dr.-Ing. Dr. h. c. Dieter Senk is responsible for the Chair of Iron and Steel Making at Dept. of Ferrous Metallurgy of RWTH Aachen University. Since more than 35 years in steelmaking industry and university he is involved with numerous research and development projects to improve CC.

Prof. Dr.-Ing. Karl-Hermann Tacke worked at Concast Zurich, was Head of the Department of Metallurgy at Max-Planck-Institut für Eisenforschung and Director of Research and Development at Dillinger Hüttenwerke. He is now an independent researcher and teaches continuous casting at Technical University Berlin.

Dr.-Ing. Jochen Wans worked as a metallurgist in the steelmaking industry before he changed his career to a plant manufacturer in the same business. Within numerous projects he is focused to connect material and process development in the field of CC. A major part of his sphere of action is dedicated to near-net-shape casting. Today he is Head of Innovation Metallurg for SMS group GmbH.