International Seminar
Continuous Casting of Steel
Practical and Scientific Approaches
August 26th to August 29th 2019
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 at 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, 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 26th August to 29th August 2019 for a special rate of EUR 110 / 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, 26th August 2019

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
Crystallisation | 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 **Problems on Heath Withdrawal**
Author: Prof. Schwerdtfeger, Speaker: Prof. Tacke

19:00 Dinner

Tuesday, 27th August 2019

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, 28th August 2019

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, 29th August 2019

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. 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.

Professor 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 Metallurgy for SMS group GmbH.

ADDITIONAL AUTHORS: 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.