International VDEh-Seminar

Continuous Casting of Steel

Practical and Scientific Approaches

August 29th to September 1st 2016, Cologne, Germany

AIM

Steel is the no 1 material in the world of technology. Automobiles, machines and countless parts of daily live 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 prepared to train persons in continuous casting of steel. In half a week the essential topics of CC are explained in detail. The lectures are supported 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.

REGISTRATION FEE

| EUR 1.470 | EUR 1.190 registration fee VAT-free + EUR 280 conference package / full board |
| EUR 1.270* | EUR 990* registration fee VAT-free + EUR 280 conference package / full board |

* 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

SUPPORTED BY

Technical Committee Continuous Casting of the Steel Institute VDEh

REGISTRATION

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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 29th August to 1st September 2016 for a special rate of EUR 99 / 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, 29th August 2016

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

14:30  **Crash Course: Fundamentals on Steel Solidification**  
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**  
Prof. Schwerdtfeger  
Heat withdrawal in the mold and secondary cooling zone • Modeling of heat flow in CC • Thermal tracking

18:00  **Exercises on Heat Withdrawal**  
Prof. Schwerdtfeger

19:00  Common Dinner

Tuesday, 30th August 2016

08:30  **Technology of CC of Steel; Cooling Systems**  
Prof. Senk  
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**  
Prof. Schwerdtfeger  
Plant data on shell growth • Non-uniformity of heat transfer and shell growth

12:30  Common Lunch

13:30  **Development of Real Solidification Structures**  
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  **Fluid Flow in Mold and SEN**  
Prof. Schwerdtfeger  
Flow pattern of steel in the mold • Meniscus fluctuations • Modification of fluid flow by electromagnetic stirring and braking • Fluid flow in the SEN

17:30  **Teamwork on Structure Control**  
Prof. Senk

19:00  Common Dinner

Wednesday, 31st August 2016

08:00  **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

12:30  Common Lunch

14:00  **Strand Guiding; Mechanical Stress and Strain**  
Prof. Senk  
Strand guiding in the mold and secondary cooling zones • Types of segments • Bending units • Stress to the as-cast strand • Hot ductility

16:00  Coffee Break

16:30  **Performance of Casting Flux in the Mold**  
Prof. Schwerdtfeger  
Performance in the mold • Principles of powder selection

18:00  **Exercises on Casting Powder**  
Prof. Schwerdtfeger

19:00  Common Dinner

Thursday, 1st September 2016

08:30  **Teamwork on Plant Design**  
Prof. Senk

09:15  **Surface Defects other than Cracks and Regular Oscillation Marks. Slabs, Blooms and Billets**  
Prof. Schwerdtfeger  
Bleeds • Laps • Depressions • Non-normal oscillation marks • Surface carburization • Surface inclusions and slag spots • Holes • Blisters and slivers

10:30  Coffee Break

11:00  **Crack formation in Continuous Casting**  
Prof. Schwerdtfeger  
Surface cracks • Fine surface or subsurface cracks • Internal cracks

12:00  Common Lunch

13:00  **Coupling of Casting and Hot Rolling**  
Prof. Senk  
Cutting production chains • Product range • Thin slab casting and inline hot rolling • Near-Net-Shape-Casting • Strip Casting

14:15  **Refractory Materials in Continuous Casting**  
Prof. Senk

14:45  Final Discussion

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. He is editor of the book “Metallurgy of Continuous Casting” and author of “Crack Formation in Steel”. 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 30 years in steelmaking industry and university he is involved with numerous research and development projects to improve CC.