

# Euroslag 2015

The 8<sup>th</sup> European Slag Conference

Conference Program, October 21–23, 2015



EUROSLAG  


voestalpine

ONE STEP AHEAD.

Wednesday, October 21, 2015

8:00 – 9:30 am	Conference registration	
9:30 – 9:40	Conference related issues	<b>S. Lackner, Austria</b> voestalpine Stahl GmbH
9:40 – 9:50	Welcome by voestalpine	<b>W. Neubauer, Austria</b> Managing director, voestalpine Stahl GmbH
9:50 – 10:00	Opening by the Chairman	<b>H. Motz, Germany</b> EUROSLAG, The European Slag Association, Duisburg

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**Topic 1: Legal and Standardization Issues (Room A)**  
(Chairman: **Claus Geiger**, voestalpine Stahl GmbH)

10:00 – 10:15	Release of dangerous substances from construction products into soil and ground-water – a status report on tests methods developed by CEN/TC 351/WG1	<b>U. Wiens, Germany</b> German Committee for Structural Concrete, Berlin
10:15 – 10:30	Resource efficiency and environmental protection: are we losing track of sustainability?	<b>G. Endemann, Germany</b> Steel Institute VDEh, Düsseldorf
10:30 – 10:45	How environmentally compatible is steel slag? Applications to be benchmarked	<b>H. Schuster, Austria</b> Greenpeace Austria
10:45 – 11:00	The new Austrian ordinance on recycling of aggregates with emphasis on steel slags: a status report	<b>J. Kraus, Austria</b> Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna
11:00 – 11:15 am	Using steel slag aggregate in road construction: a field report	<b>T. Hittler, Austria</b> Teerag Asdag

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Room A, Topic 1

**11:15 – noon** Round table discussion

**G. Endemann, Germany**  
Steel Institute VDEh,  
Düsseldorf  
**J. Kobler, Austria**  
Government Upper-Austria  
**H. Schuster, Austria**  
Greenpeace  
**T. Hittler, Austria**  
Teerag Asdag  
**J. Prammer, Austria**  
voestalpine AG

noon – 1:00 pm Lunch

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**Topic 2a: Research and Development (Room A) –  
Treatment of Slags (Chairman: Hans Kobesen)**

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**1:00 – 1:15 pm** Factors of influence during and after the electric steel making process: characterization and optimization of electric arc furnace slag

**G. Geißler, Germany**  
Max Aicher Umwelt GmbH,  
Piding

**1:15 – 1:30** Potential in iron and steel slags with the use of in situ measurements and heat recovery

**F. Firsbach, Germany**  
Department of Ferrous  
Metallurgy (IEHK)  
RWTH Aachen University

**1:30 – 1:45** Dry slag granulation with heat recovery

**A. Fleischanderl, UK/Austria**  
Primetals plc

**1:45 – 2:00** The development of Baosteel slag short flow (BSSF)

**H. Jue, China**  
Shanghai Baosteel Energy  
Service Co., Ltd.

**2:00 – 2:15 pm** The application and breakthrough of BOF slag modification technique in CSC

**Y.-H. Tseng, Taiwan**  
China Steel Corporation

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Room A, Topic 2a

<b>2:15 – 2:30 pm</b>	Blast furnace slag as functional fillers in polymer compounds	<b>A. Mostafa, Austria</b> Polymer Competence Center Leoben
<b>2:30 – 3:00</b>	Discussion	
<b>3:00 – 3:30</b>	Coffee break	
<b>3:30 – 3:45</b>	Development of continuous blast furnace slag Solidification process for low absorption coarse	<b>H. Toba, Japan</b> JFE Steel Corporation
<b>3:45 – 4:00</b>	Modelling tools for improved recovery of metal and high quality slag	<b>E. Nagels, Belgium</b> InsPyro NV, Leuven
<b>4:00 – 4:15</b>	Automatic liquid BOF slag measurement with LIBS – first experiences	<b>K. Pilz, Austria</b> voestalpine Stahl GmbH
<b>4:15 – 4:30</b>	LD-slag aging: change of chemical and physical properties and the impact on road construction	<b>F. Weiss, Austria</b> University of Technical Vienna
<b>4:30 – 4:45</b>	Valorization of steel slag as a thermal energy storage material for industrial heat storage applications	<b>I. Ortega, Spain</b> CIC energigune, Miñano
<b>4:45 – 5:15</b>	Discussion	
<b>5:30</b>	Departure from the Conference Centre to the hotels	
<b>7:30 pm</b>	Departure from the hotel to the restaurant	

Wednesday, October 21, 2015

Topic 2b: Research and Development (Room B) –  
Cement and Concrete application (Chairman: Andreas Ehrenberg)

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|----------------|---|---|
| 1:00 – 1:15 pm | Ferrous slags: a true contribution to low-carbon binders and concretes?   | <b>A. Ehrenberg</b> , Germany<br>FEhS – Building Materials Institute, Duisburg                                |
| 1:15 – 1:30    | More than 65% of slag in composite cement makes it sulfate resistant – really?  | <b>W. Matthes</b> , Switzerland<br>Holcim Technology Ltd, Holderbank  |
| 1:30 – 1:45    | New perspectives in the use of electric arc furnace slag as coarse aggregate for structural concrete                                  | <b>F. Faleschini</b> , Italy<br>University of Padova  |
| 1:45 – 2:00    | <b>Analysis of the application of ladle furnace slags from steel-works, of low and high alumina, in masonry mortars</b>               | <b>I. J. V. Ramiro</b> , Spain<br><b>TECNALIA-Sustainable Construction</b>                                    |
| 2:00 – 2:15    | A real-world experience of valorization of steel slags in the construction sector, two needs and a successful solution                | <b>F. Rancaño Lejarraga</b> , Spain<br>Áridos Siderurgicos Andaluces (Asidan), Sevilla                        |
| 2:15 – 2:30    | Development of high-density steel fiber Reinforced concrete with EAF slag aggregates for radiation shielding applications             | <b>M. Papachristoforou</b> , Greece<br>Laboratory of Building Materials, Aristotle University of Thessaloniki |
| 2:30 – 3:00    | Discussion  |   |
| 3:00 – 3:30    | Coffee break  |   |
| 3:30 – 3:45    | Application of ground granulated blast furnace slag as concrete additive in Germany: the k-value concept of DIN EN 206                | <b>V. Feldrappe</b> , Germany<br>FEhS – Building Materials Institute, Duisburg                                |
| 3:45 – 4:00 pm | The use of ground granulated blast furnace slag as a concrete addition: performance concepts of the European concrete standard EN 206 | <b>V. Feldrappe</b> , Germany<br>FEhS – Building Materials Institute, Duisburg                                |

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Topic 2b, Room B

4:00 – 4:15 pm	Performance of self-compacting concrete containing EAF slag as aggregate	A. Santamaría, Spain Faculty of Engineering – ETSI Bilbao (UPV/EHU)
4:15 – 4:30	Physical properties of non-opc mortar using blast furnace slag	M. Song, Korea Kang Won National University
4:30 – 4:45	A new process for slags from steelmaking for metal recovery and utilization in the cement industry	G. Wimmer, Austria/ Germany Primetals, Linz
4:45 – 5:15	Discussion	
5:30	Departure from the Conference Centre to the hotels	
7:30 pm	Departure from the hotel to restaurant	

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## Topic 3: Optimization of Products and their Application

(Chairman: Heribert Motz)

9:00 – 9:15 am	Utilization of steelmaking slag in Japan and recent progress toward soil amendment	Xu Gao, Japan Tohoku University
9:15 – 9:30	Use of iron and steel slag in Japan: the state of the art	T. Isawa, Japan Nippon Slag Association, Tokyo
9:30 – 9:45	Challenges contemporizing Australian Standards: Supplementary Cementitious Materials	C. Heidrich, Australia Australasian Slag Association
9:45 – 10:00 am	How to use iron and steel slags: a German view	R. Bialucha, Germany FEhS – Building Materials Institute, Duisburg

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Topic 3

10:00 – 10:15 am	Innovative use of BOF slag in agriculture by enrichment with phosphorus	<b>P. Drissen, Germany</b> FEhS – Building Materials Institute, Duisburg
10:15 – 10:30	Impact of long-term application of blast furnace and steel slags as liming materials on soil fertility and crop yields	<b>A. Morillon, France</b> AMEtech, Lyon
10:30 – 10:45	Discussion	
10:45 – 11:15	Coffee break	
11:15 – 11:30	Ladle slag: usage as sealing material	<b>K. Artl, Germany</b> AG der Dillinger Hüttenwerke
11:30 – 11:45	Porous asphalt mixtures containing ladle furnace slag	<b>M. Skaf, Spain</b> University of Burgos
11:45 – 12:00	Road asphalt performance properties using LD-slag	<b>J. Grönniger, Austria/Germany</b> Pavement Engineering Center, TU Braunschweig
12:00 – 12:15	Pavement solutions for low-volume roads using steel slags	<b>V. Ortega-López, Spain</b> University of Burgos
12:15 – 12:30	The actual safety performance of steel slag asphalt	<b>N. Jones, UK</b> Harsco Metals Group Ltd
12:30 – 12:45	Laboratory and field evaluation of hot-mix asphalt with basic oxygen furnace slag	<b>J.S. Chen, Taiwan</b> National Cheng Kung University, Tainan
12:45 – 1:00 pm	Discussion	
1:00 – 2:00	Lunch	
2:00 – 2:15	New recycled aggregates with enhanced performance for railway track bed and form layers	<b>C. Saborido, Spain</b> Comsa Emte
2:15 – 2:30 pm	The effect of chemical composition, microstructure and geometrical features on leaching behavior of electric arc furnace (EAF) carbon steel slag	<b>D. Mombelli, Italy/France</b> Politecnico di Milano

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## Thursday, October 22, 2015

### Topic 3

2:30 – 2:45 pm	V leaching in EAF slags	<b>F. Cirilli, Italy</b> Centro Sviluppo Materiali SpA, Rom
2:45 – 3:00	New applications for an aluminum slag byproduct	<b>H. Epstein, France</b> RVA, Les Islettes
3:00 – 3:15	Study of leaching process of EAF steelmaking dust with sulfuric acid	<b>M. Sharaf, Egypt</b> Ezz Steel Company, Sadat city
3:15 – 3:30	Automated sorting of refractory waste for high value recycling	<b>L. Horckmans, Belgium</b> VITO NV, Mol
3:30 – 4:00	Discussion	
4:00 – 4:10	Closing remarks of the Chairman	
4:10 – 4:40	Closing drinks	

## Thursday, October 22, 2015

### Room A

4:40 – 5:30	Workshop RFCS: project utilization of EAF slag („SLACON“)	<b>D. Algermissen, Germany</b> FEhS – Building Materials Institute, Duisburg
5:40 pm	Departure from conference centre to the hotels	

## Friday, October 23, 2015

8:45 am	Arrival at the steel plant of voestalpine Stahl GmbH, Linz	
9:00	1 <sup>st</sup> plant tour: group 1 (50 participants)	<b>Assignment during registration</b>
9:15	2 <sup>nd</sup> plant tour: group 2 (50 participants)	<b>Assignment during registration</b>
9:30	3 <sup>rd</sup> plant tour: group 3 (50 participants)	<b>Assignment during registration</b>
11:30 am	Small farewell lunch	

T. Herrero<sup>1,\*</sup>, I. Vegas<sup>1</sup>, J.T. San-José<sup>2</sup>, J.J. González<sup>2</sup>, D. García<sup>1</sup>, A. Santamaría<sup>2</sup>

## **Analysis of the application of ladle furnace slags from steel-works, of low and high alumina, in masonry mortars**

<sup>1</sup>TECNALIA-Sustainable Construction (SPAIN), <sup>2</sup>UPV/EHU – ETSI Bilbao (SPAIN), \*Corresponding author

### **Abstract**

Ladle Furnace (basic) Slag (LFS) by-products from the steel industry are generated after the basic refining of steel. This manufacturing process yields two types of LFS that are either low or high in alumina, depending on the saturation method. Over the past decade, the hydraulic reactivity of LFS, among its other properties, has been exploited in the construction sector by the addition of LFS fines in Portland cement matrixes (pastes and masonry mortars). This research work focuses on two aspects: the study of LFS in itself and the assessment of its performance in cement matrixes. To do so, a characterization of LFS is performed by DRX, TGA, and chemical analyses. Moreover, its volumetric stability and a series of controlled hydration reactions are studied. Our experimental studies of LFS in cement matrixes involve the preparation of cement pastes and (non-structural) masonry mortars, to analyse their volumetric instabilities and shrinkage. In these studies, masonry mortar designs in which under 20% of the cement by weight was replaced by LFS with a high content of alumina showed a better physical-chemical performance than mortar designs incorporating LFS with a high content of silica.

The CEM I mortars, with a partial substitution of EB1, improved their mechanical responses under compression loads, when compared with CEM II and lime filler mixes.

Interestingly, a dimensional variation of the cement mortars with 10% EB1 and EB2 in substitution of type I cement was observed in relation to mortar shrinkage analysis.

Slag mortars are expansive. After 28 days the EB1 and EB2 mortars presented values of 0.09 mm/m and 0.05 mm/m, respectively. After 75 days the expansion values stabilized in values of 0.120 mm/m for EB1 and 0.08 mm/m for EB2. The average expansion value was 0.1 mm/m for both slags and could partially compensate the expected shrinkage of the dry mortars, at around 0.5 mm/m.

## 5 Conclusions

- This paper has mainly analysed the characterization and stabilisation of EB1 and EB2 and the corresponding pastes and masonry mortars containing LFS in partial substitution of cement.
- The conclusions are that the physical-chemical performance of high-alumina LFS is better than the physico-chemical performance of high-silica LFS. The LFS should not be wetted.
- Ladle furnace basic slag can induce slight hydraulic reactivity. Partial replacement of cement by ladle furnace (basic) slag under 20% by weight of cement has no negative effect on mechanical performance and shrinkage.

## Acknowledgements

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