**Unified International Technical Conference on Refractories (UNITECR)**
**18th Biennial Worldwide Congress on Refractories**

26th – 29th September 2023
Germany | Frankfurt am Main | Kap Europa

UNITECR 2023

Deutsche Feuerfest Industrie e.V. DFFI

European Centre for Refractories ECREF

# PROGRAM

# THE CARBON CHALLENGE

## Steps and leaps to master the future

# TABLE OF CONTENTS



**DEAR UNITECR PARTICIPANTS**
**DEAR FRIENDS OF THE REFRACTORY INDUSTRY**

This program provides you with an overview of everything that will be offered at the conference in Frankfurt from 26th to 29th September.

You will also find the schedule of the individual lectures here - with title, room, time and name of the speaker.

We have produced a separate Proceedings for the manuscripts of the lectures and posters in total.

**With reference to your registration and consent to *§IX Photographs*, we point out that by registering and accepting the terms and conditions, you have already agreed that we may take photos and film recordings in order to use them for communication in the media afterwards.**



# PROCEEDINGS

**Online access to the Proceedings**
The online access (QR-code and URL given here) is only available until 6th October 2023. As a registered participant you will also receive a link directly by email to download the Proceedings.

This link is protected via your username and password.

https://events.mcon-mannheim.de/frontend/index.php?folder_id=2371&page_id=

# WLAN

**You have free access to WLAN on all congress days.**

# SPONSORS

We would like to thank the sponsors who made it possible to develop UNITECR 2023 into a very special event. Whether it's important conference elements such as pens, pads or the conference bag, the events, the Welcome Evening or the Conference Dinner, all of this has been prepared even better for you with their support.

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We would like to thank the media partners who helped us to publicize this UNITECR conference worldwide. With their support and also with the commitment in the social networks, UNITECR has grown into an outstanding event in 2023.

bulletin

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# ORGANISATION

## UNITECR 2023

### HOST

Deutsche Feuerfest-Industrie e.V. (DFFI)
*German Refractory Association*

### ORGANIZATIONAL OFFICE

European Centre for Refractories gGmbH (ECREF)

Thomas Kaczmarek (Secretary General UNITECR 2023)
Dr. Christian Dannert (Secretary Scientific UNITECR 2023)

Rheinstrasse 58
56203 Höhr-Grenzhausen | Germany

+49 2624 9433 125

office@unitecr2023.org

### CONFERENCE VENUE

Kap Europa

Osloer Str. 5
60327 Frankfurt am Main | Germany

### UNITECR OFFICERS

Dr. Andus Buhr (UNITECR President)
Prof. Dr. Christos G. Aneziris (UNITECR Vice President, Chairman of the Scientific Committee)

### ORGANISATION TEAM

Prof. Dr. Christos G. Aneziris, Dr. Andus Buhr, Dr. Christian Dannert, Ulf Frohneberg, Dr. Rainer Gaebel, Thomas Kaczmarek

### LOCAL ORGANIZER AND SUPPORT

**m:con – mannheim:congress GmbH**

Rosengartenplatz 2
68161 Mannheim | Germany

Mila Brnovic
Registration Management

unitecr.registration@mcon-mannheim.de
+49 621 4106 6805

### SCIENTIFIC COMMITTEE

Chairman: Prof. Dr. Christos G. Aneziris

**Raw Materials**
Dr. Christoph Wöhrmeyer

**Advances in Monolithic Technology**
Prof. Dr. Olaf Krause

**Refractories for Iron- and Steelmaking**
Prof. Dr. Helge Jansen

**Refractories for Non-Ferrous Metallurgy**
Daniel Cölle

**Refractories for Non-Metal Industries**
Dr. Stefan Postrach

**Modelling and Digitalization**
Rinus Siebring

**Education**
Dr. Dietmar Gruber

**Testing and Standardization**
Dr. Christian Dannert

**Basic Refractory Science and Technology Transfer**
Prof. Dr. Dr. h.c. Peter Quirmbach



# WELCOME ADDRESS

**Dear member of the refractory family,**

**as Chairman of the German Refractory Association it is a great honour for me to welcome you in Frankfurt to the UNITECR 2023. We appreciate your initiative to join us in the beautiful Kap Europa for a unique conference. Welcome!**

**Ulf Frohneberg**
Host UNITECR 2023

"The Carbon Challenge" is the motto of this international conference. The motto represents the role of the refractory producers in the global transformation of the industry towards $CO_2$-neutral production of steel, glass, cement, non-ferrous metals, chemicals and many other products. This transformation under competitive conditions, which is indeed a major challenge for all stakeholders, be it from business, industry or society, is only possible with the help of refractory products. Without refractory products, there will be no wind power plants, no photovoltaic plants, no DRI, no hydrogen. The refractory industry is a necessary technology partner of the whole industry and stands ready with all its know-how to help, shape and develop the processes of the future.

UNITECR 2023 offers an excellent platform of exchange for you experts from the worldwide refractory industry together with professionals from the user industries. Over the three days, more than 250 technical papers will be presented, framed by a large poster show and a trade exhibition. The welcome reception on the eve of the conference, as well as the conference dinner Thursday will provide you a fantastic atmosphere for networking.

However, the transformation of the industry also offers the refractory industry another great opportunity, namely that of an image change towards a system-relevant high-tech industry. We, the refractory industry, should use this opportunity to increase our perception in politics and society with a broad chest on the one hand, and at the same time to increase our attractiveness as employers in a sustainable high tech industry that is crucial for the transformation towards a greener world.

I am looking forward to meet fellow members of the refractory family and to make new friends on the largest technical colloquium the global refractory industry has to offer.

I wish you fruitful meetings and new insights.

Glückauf!

Yours

**Ulf Frohneberg**
Host UNITECR 2023

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*German Refractory Association*

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# WELCOME TO THE CARBON CHALLENGE

**Dr. Andus Buhr**
President UNITECR 2023

**"The Carbon Challenge: steps and leaps to master the future" is our motto at the UNITECR over the three days in Frankfurt - and for the coming years as we drive forward the transformation of our industry.**

Refractories are an important tool for the energy intensive high temperature industries who strive towards reduced $CO_2$ emission and achieving carbon-neutrality in the not too distant future. At UNITECR, experts, researchers and professionals from all over the world come together to expand knowledge and find solutions to the challenges facing the industries.

Steps or incremental improvements of refractory materials and lining concepts enable lower heat losses in processes. This aspect is gaining increasing momentum in the industry. Disruptive technology changes such as carbon-neutral steel production and the replacement of fossil fuels in high temperature processes require leaps in refractories and lining concept development. Both, steps and leaps are addressed in our technical program.

An important part is the recycling economy to conserve limited resources and reduce the ecological footprint in the refractory industry. Regional value chains with close cooperation between suppliers, users and other stakeholders involved are essential. There are good examples of this already taking place.

Modern tools such as big data analysis, machine learning, and the development of suitable models help to increase the speed of innovation in our industry. We have examples in our program. The job of a refractory engineer offers interesting challenges for young talent, men and women. It provides meaningful work by contributing to new technologies enabling reductions in $CO_2$ emission.

There will be a leap in knowledge after this conference, which will be of enormous importance to all of us. We hope that you will experience inspiring presentations, exciting discussions and valuable networking opportunities during the conference. The UNITECR conference is known for its high-profile speakers and poster sessions. New are five panel debates on special topics that we have developed especially for this conference. Experience the exchange of opinions live and join the discussion!

Use this opportunity to expand your knowledge, exchange ideas with colleagues from the industry and discover new cooperation opportunities! We are confident that this conference will provide you with valuable insights and ideas for your work and research.

Prof. Dr. Christos G. Aneziris, as Vice President of UNITECR 2023 and Chairman of the Scientific Committee, and his team have ensured high quality and diversity. The conference program and the poster exhibition were compiled from over 330 submissions.

We both look forward to seeing you. Once again, welcome to the UNITECR 2023. We wish you an inspiring and successful event!

We would like to thank all speakers, chairmen, participants, exhibitors and organisers who have contributed to this event.

**Dr. Andus Buhr**
President UNITECR 2023

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# THE STORY OF UNITECR 2023

UNITECR has been formed as a joint effort to organise unified technical conferences on refractories in 1989. Since then, biannual conferences have circled the world between the countries of the four founding members of UNITECR: North America (founding member: American Ceramic Society, ACerS), Europe (founding member: Deutsche Feuerfest-Industrie, DFFI), South America (founding member: ALAFAR) and Japan (founding member: Technical Association of Refractories Japan, TARJ). We are now in the fifth iteration of that circle, with this year's UNITECR organised by the European founding member DFFI in Frankfurt. Welcome!

OVER
» **330** SUBMISSIONS
» **219** SPEAKERS
» **53** POSTERS

The previous UNITECR in Chicago in 2022 marked the first public presentation for this year's event, introducing Frankfurt as the venue with a short film during the dinner. While the two designated Frankfurt event venues, Kap Europa and the Palmengarten, had long been reserved, it was now a matter of invigorating the 2023 topic "The Carbon Challenge" and promoting it worldwide.

The "Call for Paper" for scientific contributions in March 2022 attracted over 330 submissions by December 2022. Over the Christmas period, the Scientific Committee evaluated the submissions and created the structure of the scientific conference, assigning the submissions to the nine session topics of UNITECR 2023. 219 speakers were initially invited and asked to present their research during UNITECR. They also outlined their work in scientific papers, which we have published in the Proceedings that you can download via a QR code or URL (see page 1) and in a Special Issue of the scientific journal "Open Ceramics". The scientific lectures will be interspersed with panel discussions, in which invited experts will discuss with the audience topics of special interest to the headline of UNITECR 2023, "The Carbon Challenge".

In addition to the scientific lectures, a large number of researchers have been invited to prominently display their work on posters which are shown in a prominent position at the venue during the whole event. In a novel format of a poster SLAM (see page 30) they will also have the opportunity to present their work to an expert audience as a short pitch, with the best three short presentations honoured with a poster AWARD (see page 35).

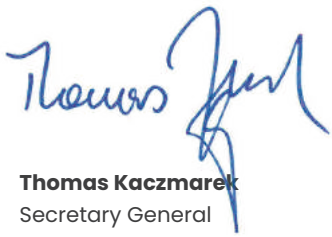
Events such as Young Professionals, Women@Refractories and the presentation of the 2023 Gustav Eirich Award will run in parallel and as part of the conference. Furthermore, and also parallel to the conference, an accompanying industry exhibition will take place on all floors of the venue. It is our pleasure to welcome these companies, which offer tailored products and services to the refractory industry.

Media partners are an active partner in UNITECR, spreading the news about the event sustainably in the social networks. Many thanks for this.

We would like to take this opportunity to thank our sponsors. They made it possible for the one or other event to be even more tailored to you as participants.

When we have waved goodbye to the last of our guests on Friday afternoon, we hope that you will take with you fond memories of UNITECR 2023.

We wish you a few fantastic UNITECR days.



**Thomas Kaczmarek**
Secretary General
UNITECR 2023

**Dr. Christian Dannert**
Secretary Scientific
UNITECR 2023

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- Magnesite
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- Cellulose Powder
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# SCHEDULE AT A GLANCE

## TUESDAY

**WELCOME EVENING**

## WEDNESDAY

**GRAND OPENING**

- Customers: Dr. Marie Jaroni (thyssenkrupp Steel Europe)
- Science and Media: Ranga Yogeshwar (science journalist)
- Politics: Parliamentary State Secretary Michael Kellner (German Federal Ministry of Economic Affairs and Climate Action)

**POSTERS**

SLAM – AWARD – WALK

EXHIBITION (Wednesday-Friday)

**WOMEN@REFRACTORIES**

Glass ceiling or sticky floor? Get leadership inspiration, connect and exchange with the female force of the refractory industry.

**SCIENTIFIC PROGRAM**

17 sessions & 2 panel discussions



## THURSDAY

**GUSTAV EIRICH AWARD**

Prizegiving for the three best dissertations (Ph.D. theses) in the field of refractories.

**YOUNG PROFESSIONALS**

Invitation of participating students to exchange ideas on the latest developments about virtual reality and receive an invitation to the Conference Dinner in the Palmengarten.

**CONFERENCE DINNER**

- Appointment of the Distinguished Life Members 2023
- Presentation of the upcoming UNITECR 2025

**SCIENTIFIC PROGRAM**

30 sessions & 3 panel discussions

## FRIDAY

**SCIENTIFIC PROGRAM**

12 sessions


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# WELCOME EVENING

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### TUESDAY 26TH SEPTEMBER

**06.00 PM – 11.00 PM, Room Horizont**

After eight years, UNITECR returns to Germany. On the evening before the conference, the focus will be on reuniting and networking. Not least because of the worldwide COVID-19 pandemic, all participants are looking forward to this welcome evening to meet colleagues from their professional life and also friends again face to face.

**The doors at Kap Europa will be open from 05.00 PM.**

Kap Europa is a Messe Frankfurt location.

### SCHEDULE

**06.00 PM** WELCOME ADDRESS

| | |
|---|---|
| • UNITECR President 2023 | Dr. Andus Buhr |
| • UNITECR Vice President | Prof. Dr. Christos G. Aneziris<br>Honouring of the Scientific Committee |
| • Event Sponsor | RHI MAGNESITA \| Constantin Beelitz<br>*Regional President Europe, CIS & Türkiye* |

**AWARD OF FIRE DIPLOMA FOR THE RECENT COHORT OF STUDENTS**

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Federation for International Refractory Research and Education (FIRE)
Chairman: Chris Parr

### MUSIC

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# GRAND OPENING – KEYNOTES

## WEDNESDAY, 27TH SEPTEMBER

**10.00 AM – 12.10 AM, Room Horizont**

With our lead topic The Carbon Challenge we have defined three pillars for the UNITECR opening: political framework and customer orientation as well as resilience and sustainability.

We are glad to have **Dr. Marie Jaroni** representing a major customer industry with her keynote. Leading the team "Decarbonization and Sustainability" at thyssenkrupp Steel she will explain how six million tons of $CO_2$ can be avoided by thyssenkrupp annually by 2030.

Moreover it was possible to win **Ranga Yogeshwar** for a keynote. With a degree in particle physics Ranga created and hosted numerous television programs and has received more than 60 awards, including honorary doctorates from the universities of Koblenz-Landau and Wuppertal as well as an honorary professorship from Bonn-Rhein-Sieg University of Applied Sciences. Today he is one of the leading independent science journalists and key-note speakers in Germany.

Parliamentary State Secretary **Michael Kellner** from the German Federal Ministry of Economic Affairs and Climate Action will give a political perception on our lead topic via video.

**Dr. Marie Jaroni**

**Ranga Yogeshwar**

**PSts Michael Kellner**

10.00 AM - 10.15 AM
**Ulf Frohneberg** (STEULER)
*Chairman of the Board Deutsche Feuerfest-Industrie (DFFI)*
**Global Decarbonization - Opportunities for the Refractory Industry**

10.15 AM - 10.30 AM
**Dr. Andus Buhr** (ALMATIS)
*President UNITECR 2023*
**The Carbon Challenge**

10.30 AM - 11.15 AM
**Dr. Marie Jaroni** (thyssenkrupp Steel Europe)
*Head Of Decarbonization and Sustainability*
**Steel industry on the way to a decarbonized future: opportunities and challenges of the green transformation**

11.15 AM - 12.00 AM
**Ranga Yogeshwar**
*Science Journalist / Physicist*
**Emil's World – A Society in Transition**
About the urgent need of a deeper culture-shift and what it means to grow up surrounded with talking devices, artificial intelligence and changing social interactions.

12.00 AM - 12.10 AM
**Michael Kellner** (German Federal Ministry of Economic Affairs and Climate Action)
*Parliamentary State Secretary*


How can refractory technology contribute to the necessary transformation? Tomorrow's professionals can find answers and our »REFRAup« young professionals program is set to shed light on new and young perspectives for reaching the next level of refractory technology.
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UNITECR 2023

REFRATECHNIK

# CONFERENCE DINNER

## SPONSORED BY REFRATECHNIK

## THURSDAY 28TH SEPTEMBER

**06.30 PM – 00.00 PM, Gesellschaftshaus Palmengarten**
**Palmengartenstraße 11, 60325 Frankfurt am Main**

On Thursday, a very special dinner will take place in Frankfurts Palmengarten. A fantastic location, with excellent food, delicious drinks and a music program worth hearing guarantee a lasting impression for all participants.
It is not held as a well seated Gala Dinner but rather as a dynamic meet and greet, so that there is the opportunity to maintain contacts and make new ones at many tables.

After a casual reception with an aperitif on the terrace, the historic ballroom with its magnificent ornaments from the Neo-Renaissance invites you to linger. Besides impressions of the congress day and the official welcome of the UNITECR hosts, a creative buffet with regional and seasonal delicacies awaits you.

The special setting in this building is underlined by the award of the UNITECR certificates to the three nominated Distinguished Life Members (DLM). A second highlight is the presentation of the next UNITECR location for the year 2025.

The Conference Dinner is always a main highlight at UNITECR events - in addition to the scientific lectures, of course. Here, too, is room for debate about what has been heard so far. Speakers, poster exhibitors and guests can engage in discussions with each other.

From 09.00 PM., as an exclusive highlight, the legendary Palm House Terrace will be available for dancing. Surrounded by beautiful Wilhelminian time plant stands and to the sounds and tunes of a Frankfurt scene DJ, the evening guarantees a very good mood.

**The doors of the Palmengarten will be open from 06.30 PM.**

## SCHEDULE

| | | |
|---|---|---|
| 06.30 PM | **Opening Palmengarten** | |
| 07.15 PM | **Opening Address** | Dr. Rainer Gaebel<br>*Managing Director Refratechnik Holding*<br>Event Sponsor |
| | **Words of Welcome** | Dr Andus Buhr, *UNITECR President 2023* |
| | **Certificates to DLM** | Dr. Andus Buhr<br>Tom Vert, *UNITECR President 2022*<br>Genaro F. Cueva, *UNITECR President 2025* |
| | **Invitation to UNITECR 2025** | Genaro F. Cueva |

## MUSIC

SWING TO GO and DJ

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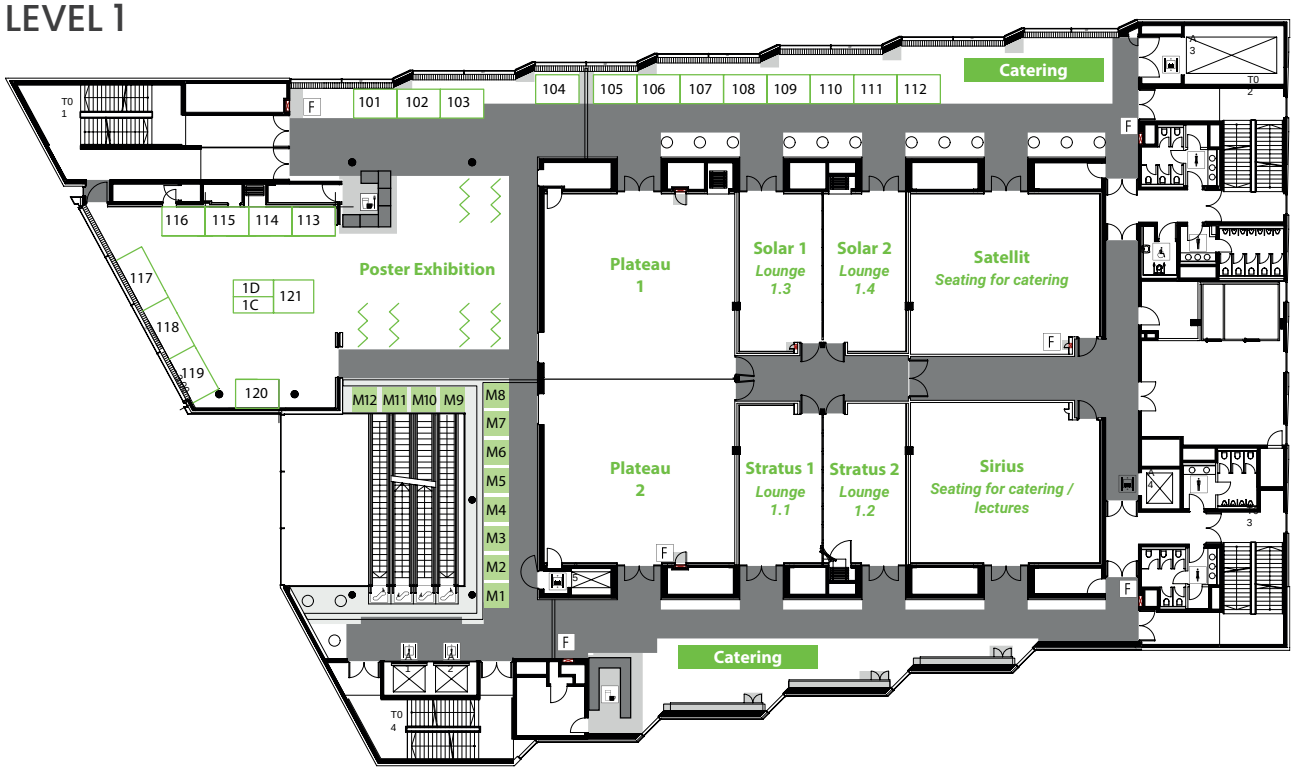
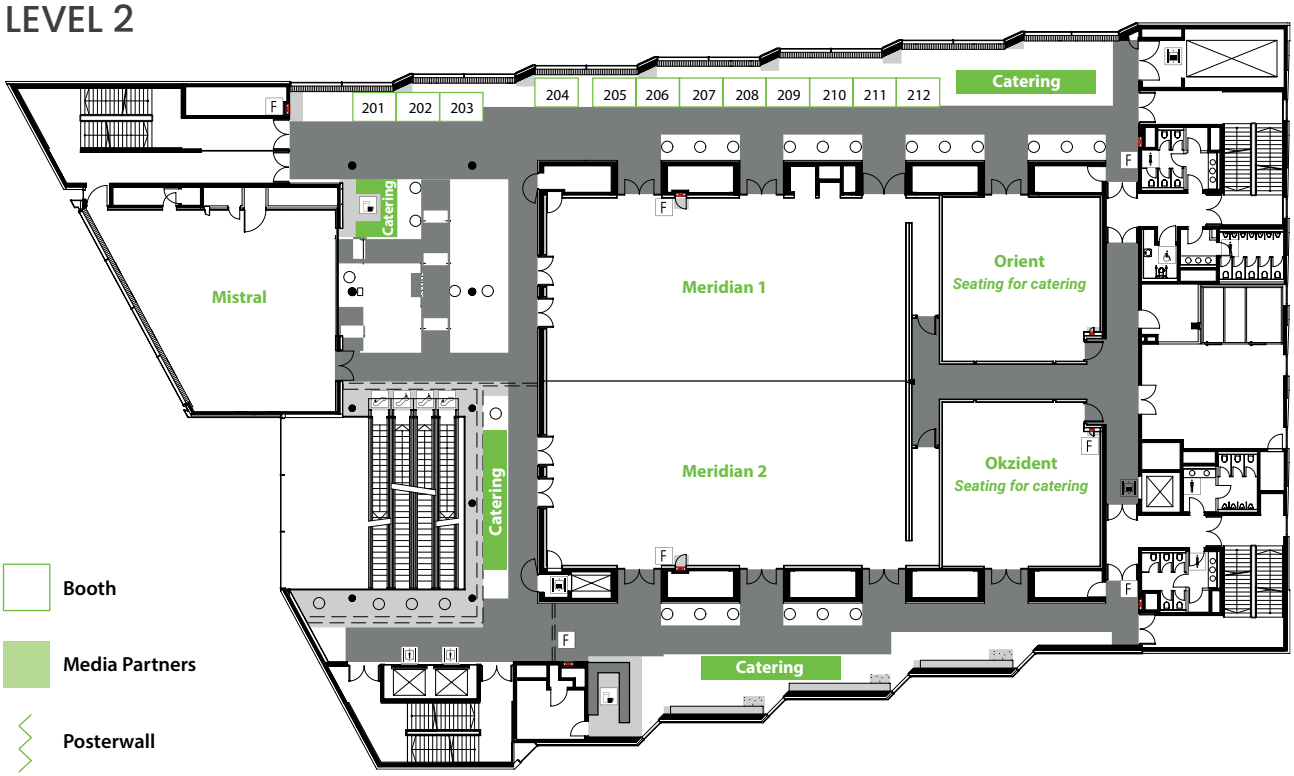
# FLOOR PLAN

## LEVEL 1

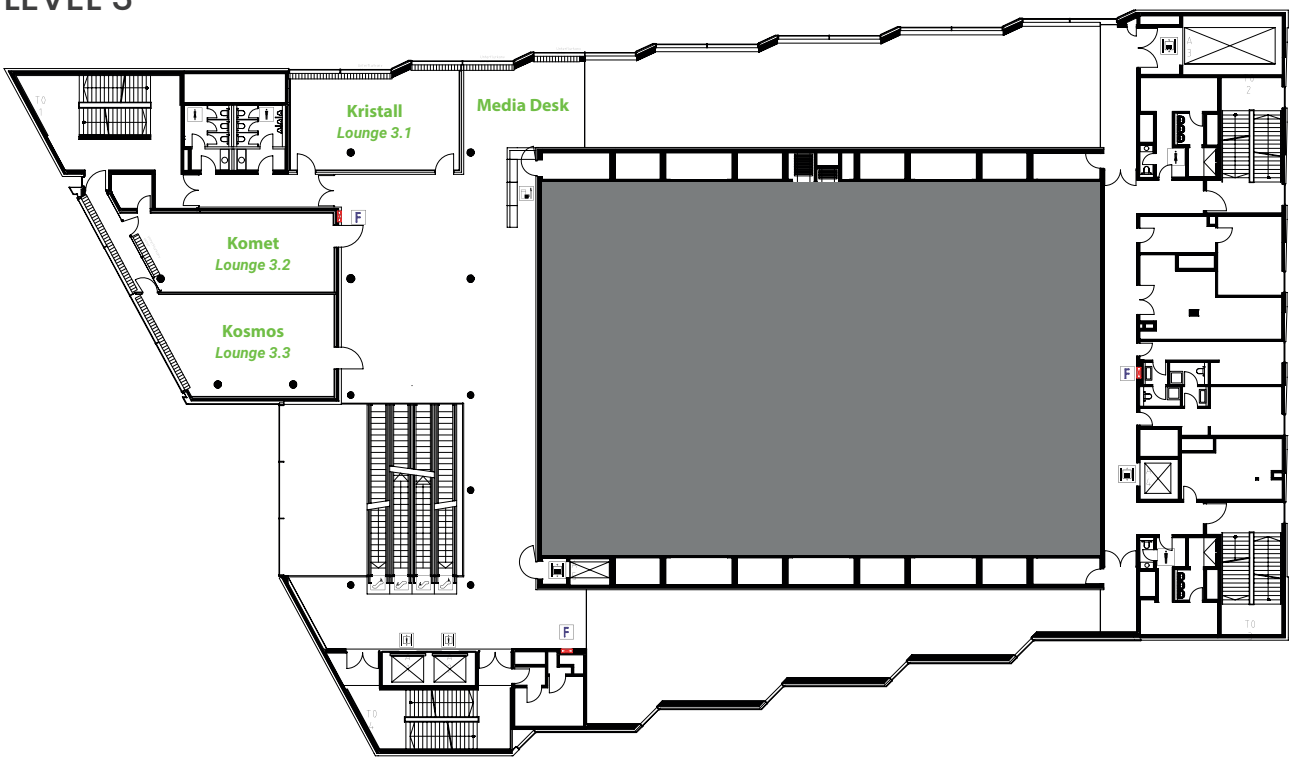



## LEVEL 2

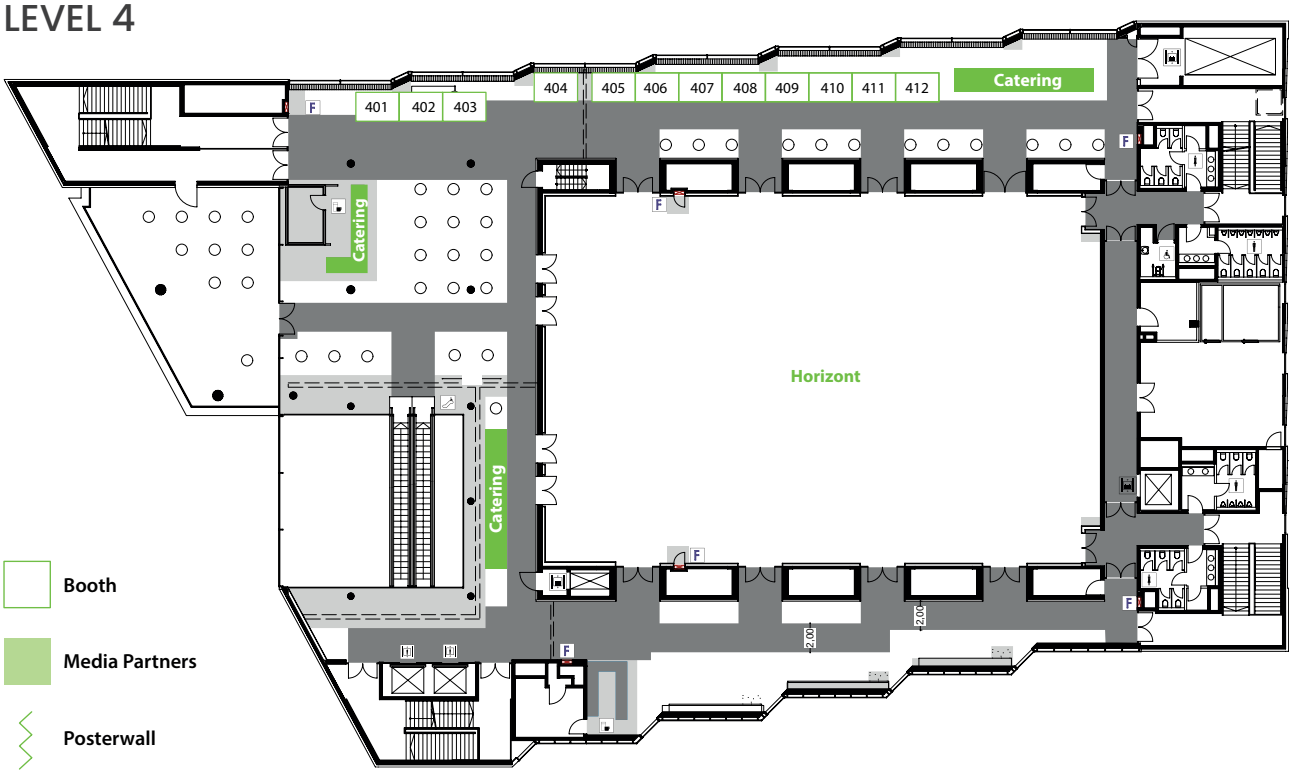


# FLOOR PLAN

## LEVEL 3




## LEVEL 4



# WEDNESDAY
## 27TH SEPTEMBER

## ⟫ *QUICK TIPS*

# SCHEDULE WEDNESDAY 27TH SEPTEMBER

| | PLATEAU 1 | PLATEAU 2 | MISTRAL |
|---|---|---|---|
| 09.00 AM | | | |
| 10.00 AM | | | |
| 11.00 AM | | | |
| 12.00 AM | | | |
| 01.00 PM | LCA OF REFRACTORIES / HYDROGEN I<br>01.00 PM – 02.40 PM P. 24 | IRONMAKING I<br>01.00 PM – 02.20 PM P. 24 | TESTING AND STANDARDIZATION I<br>01.00 PM – 02.40 PM P. 25 |
| 02.00 PM | | | |
| 03.00 PM | MODELLING IN INDUSTRIAL REFRACTORY PRACTICE<br>03.00 PM – 04.00 PM P. 28 | IRONMAKING II<br>03.00 PM – 04.20 PM P. 28 | TESTING AND STANDARDIZATION II<br>03.00 PM – 04.20 PM P. 29 |
| 04.00 PM | | | |
| 05.00 PM | POSTER SLAM<br>04.40 PM – 06.00 PM P. 30 | IRONMAKING III<br>04.40 PM – 05.40 PM P. 33 | TESTING AND STANDARDIZATION III<br>04.40 PM – 05.40 PM P. 33 |
| 06.00 PM | POSTER AWARD<br>06.00 PM – 06.20 PM P. 35 | | |
| | POSTER WALK<br>Foyer Level 1<br>06.20 PM – 07.30 PM P. 35 | | |
| 07.00 PM | | | |

# SCHEDULE WEDNESDAY 27TH SEPTEMBER

| | MERIDIAN 1 | MERIDIAN 2 | HORIZONT |
|---|---|---|---|
| 09.00 AM | | | |
| 10.00 AM | | | GRAND OPENING<br>10.00 AM – 12.00 AM P. 15 |
| 11.00 AM | | | |
| 12.00 AM | | | |
| 01.00 PM | MONOLITHIC REFRACTORIES I<br>01.00 PM – 02.40 PM P. 26 | RAW MATERIALS – BASIC MATERIALS<br>01.00 PM – 02.40 PM P. 26 | PRIMARY METALLURGY I<br>01.00 PM – 02.00 PM P. 27 |
| 02.00 PM | | | PANEL DISCUSSION – TRANSFORMATION STEEL INDUSTRY I: SMELTING OF DRI<br>02.00 PM – 02.40 PM P. 27 |
| 03.00 PM | MONOLITHIC REFRACTORIES II<br>03.00 PM – 04.00 PM P. 30 | RAW MATERIALS – BINDERS I<br>03.00 PM – 04.00 PM P. 29 | HYDROGEN II<br>03.00 PM – 03.40 PM P. 29 |
| 04.00 PM | | | PANEL DISCUSSION – TRANSFORMATION OF THE STEEL INDUSTRY II: HYDROGEN RESISTANCE OF REFRACTORIES<br>03.40 PM – 04.20 PM P. 30 |
| 05.00 PM | MONOLITHIC REFRACTORIES III<br>04.40 PM – 05.40 PM P. 34 | RAW MATERIALS – BINDERS II / SECONDARY MATERIALS I<br>04.40 PM – 06.00 PM P. 34 | HYDROGEN III<br>04.40 PM – 06.00 PM P. 35 |
| 06.00 PM | | | |
| 07.00 PM | | | |

# WEDNESDAY 27TH SEPTEMBER

## GRAND OPENING

HORIZONT

10.00 AM – 12.00 AM

## LCA OF REFRACTORIES / HYDROGEN I

Chairs: Dannert, C., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); Léonard, A., University of Liége (Liége, BE)

PLATEAU 1

01.00 PM – 02.40 PM

**01.00 PM** **Life cycle environmental and cost assessment of ladle refractories management according to circular economy criteria**
Muñoz, I., 2.-0 LCA consultants (Barcelona, ES)

**01.20 PM** **Insulating Refractories as an Enabler to Carbon Sustainability, Demonstrated through Life Cycle Assessment.**
Mottram, R., Morgan Advanced Materials (Bromborough, GB)

**01.40 PM** **Overview on LCA: challenges and opportunities for the refractory industry**
Menezes Cunha, J., RHI Magnesita GmbH (Leoben, AT)

**02.00 PM** **Refractory innovations under the target of carbon dioxide peaking and carbon neutrality in China**
Li, H., Sinosteel Luoyang Institute of Refractories Research Co., Ltd. (Luoyang, CN)

**02.20 PM** **Hydrogen: an issue and a new challenge for the durability of refractories**
Poirier, J., University of Orleans (Orleans, FR)

## IRONMAKING I

Chairs: Schepers, A., Beck u. Kaltheuner Feuerfeste Erzeugnisse GmbH & Co. KG (Plettenberg, DE); Sinha, S., Calderys India Refractories Ltd (Nagpur, IN)

PLATEAU 2

01.00 PM – 02.20 PM

**01.00 PM** **End of petroleum tar binder, new generation of tap-hole clay. Formaldehyde and PAH free technology**
Joly, T., Vesuvius Europe (Décines, FR)

**01.20 PM** **Comparative study between coal tar pitch and lower polycyclic aromatic hydrocarbon (PAH) alternative binders for use in taphole clays**
Cameron, I., University of Pretoria (Pretoria, ZA)

**01.40 PM** **Development of High Performance Tap Hole Clay**
Patranabish, T., Calderys (Nagpur, IN)

**02.00 PM** **Behavior of carbon-based binders for blast furnace taphole clays focused on environment, safety, and performance**
Oliveira, T., Universidade Federal de Minas Gerais (Belo Horizonte, BR)

**JOIN US AT THE *POSTER SLAM***

**Reseachers and scientists will present the main features of their work in one minute.**

→ PAGE 30

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# WEDNESDAY 27TH SEPTEMBER

## TESTING AND STANDARDIZATION I

Chairs: Krause, O., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE); Abdelouhab, S., Belgian Ceramic Research Centre (Mons, BE)

MISTRAL

01.00 PM – 02.40 PM

**01.00 PM** **In situ high-temperature Raman spectroscopy: A powerful tool for studying refractory materials**
Zimmer, S., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**01.20 PM** **Material characterization & product analysis of refractories via X-ray computed tomography**
Lüftner, D., RHI Magnesita GmbH (Leoben, AT)

**01.40 PM** **Fracture energy determination of carbon-containing refractories with consideration of the creep behaviour**
Gruber, D., Montanuniversität Leoben (Leoben, AT)

**02.00 PM** **Investigation of the simultaneous influence of mechanical loading and thermal gradient as occurring in refractory linings on the refractory microstructure and physical properties**
Brochen, E., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE)

**02.20 PM** **Application of Ultra–High Speed Heating Test System – Evaluation of Thermal Conductivity –**
Nakabo, K., Okayama Ceramics Research Foundation (Okayama, JP)

# WEDNESDAY 27TH SEPTEMBER

## MONOLITHIC REFRACTORIES I

Chairs: Angelkort, J., Intocast AG (Krefeld, DE); Peng, H., Elkem Silicon Products Development (Kristiansand, NO)

MERIDIAN 1

01.00 PM – 02.40 PM

**01.00 PM** **Novel colloidal silica technology for MgO-containing refractories – Part 1: Anti-hydroxylation binder**
Salomão, R., University of São Paulo (São Carlos, BR)

**01.20 PM** **Investigating the MgO castable's hydration mechanism by hydratable alumina substitution for calcium aluminate cement, and phase formation at high temperature using nano-$MgAl_2O_4$ additives**
Nourbakhsh, A., Arvin Dirgodaz Vijeh Co (Isfahan, IR); Davoudian, R., Arvin Dirgodaz Vijeh Co (Isfahan, IR)

**01.40 PM** **Novel colloidal silica technology for MgO-containing refractories – Part 2: "In situ" spinelization**
Salomão, R., University of São Paulo (São Carlos, BR)

**02.00 PM** **The in-situ spinel formation in a magnesia alumina castable and the effect of selected additives on the properties of the castable**
Angelkort, J., Intocast AG (Krefeld, DE)

**02.20 PM** **A novel approach to develop sustainable cement-free magnesia castables**
Peng, H., Elkem Silicon Products Development (Kristiansand, NO)



## RAW MATERIALS – BASIC MATERIALS

Chairs: Prietl, T., RHI Magnesita (Vienna, AT); Li, Y., Wuhan University of Science and Technology (Wuhan, CN)

MERIDIAN 2

01.00 PM – 02.40 PM

**01.00 PM** **From lab to plant – from mine to refractory bricks: Making use of a new dolomite raw material source in Europe**
Ebner, C., RHI Magnesita GmbH (Leoben, AT)

**01.20 PM** **Designing eco-friendly alternative to the magnesia-chromite aggregates**
Borges, O., Federal University of São Carlos (São Carlos, BR)

**01.40 PM** **Development of novel DBM portfolio for Steel, Cement and Glass Refractories**
Naves Moraes, M., RHI Magnesita (Belo Horizonte, BR)

**02.00 PM** **An Approach to Purify Natural Magnesite and to Densify Sintered Magnesia**
Guo, Z., Liaoning Fenghua Industrial Corporation (Yingkou, CN)

**02.20 PM** **Enhanced performance of free CaO impurity containing magnesia with $Al_2O_3$-$TiO_2$ composite powder**
Xu, Y., Wuhan University of Science and Technology (Wuhan, CN)

# WEDNESDAY 27TH SEPTEMBER

## PRIMARY METALLURGY I

Chairs: Mertke, A., Salzgitter Flachstahl GmbH (Salzgitter, DE); Vert, T., Strategic Refractory Consulting Inc (Hamilton, CA)

HORIZONT

01.00 PM – 02.00 PM

**01.00 PM** **New Ways To Destroy Refractories – the Future of Green Steelmaking!**
Vert, T., Strategic Refractory Consulting Inc (Hamilton, CA)

**01.20 PM** **Transformation to hydrogen-based steel making and refractory challenges at thyssenkrupp Steel Europe AG in Duisburg**
Weinberg, M., thyssenkrupp Steel Europe (Duisburg, DE)

**01.40 PM** **Decarbonisation of Steel Industry and its Impact on future slag**
Volkova, O., TU Bergakademie Freiberg (Freiberg, DE)

## PANEL DISCUSSION - TRANSFORMATION OF THE STEEL INDUSTRY I: SMELTING OF DRI

Moderation: Mertke, A., Salzgitter Flachstahl GmbH (Salzgitter, DE)

Weinberg, M., thyssenkrupp Steel Europe (Duisburg, DE); Jansen, H., Refratechnik (Düsseldorf, DE); Moulin-Silva, W., RHI Magnesita (Vienna, AT); Louw, S., Metix-SMS (Sandton, ZA); Volkova, O., TU Bergakademie Freiberg (Freiberg, DE); Garbers-Craig, A., University of Pretoria (Pretoria, ZA); Algermissen, D., FEhS-Institut für Baustoff-Forschung (Duisburg, DE)

HORIZONT

02.00 PM – 02.40 PM

Smelting of direct reduced iron (DRI) has specific implications for the refractory lining of the electric arc furnaces because the DRI still contains all the gangue from the iron ore. When taking into account that regular DRI pellets have gangue content of up to 10%, a large amount of slag is created during the smelting process. This slag is rather acidic. An acidic slag composition is required for making use of it as alternative to blast furnace cement. It is a very interesting question how the existing basic refractory lining concepts for electric arc furnacs and submerged arc furnaces (or open bath furnaces) may change due to the new process conditions. An international group of experts from the steel and refractory industries, OEM, and research institutions will discuss this in a panel at UNITECR.

# WEDNESDAY 27TH SEPTEMBER

## MODELLING IN INDUSTRIAL REFRACTORY PRACTICE

Chairs: Gruber, D., Montanuniversität Leoben (Leoben, AT); Huger, M., IRCER, University of Limoges (Limoges, FR)

PLATEAU 1

03.00 PM – 04.00 PM

**03.00 PM** **A coupled thermo-chemo-mechanical approach to simulate the oxidation of SiC-based refractory castable**
Sayet, J., Univ. Orléans, LaMé (EA7494, Univ. Orléans, Univ. Tours, INSA CVL) (Orléans, FR)

**03.20 PM** **Thermodynamics of interfaces in the refining of clean steels and its importance to the design of ceramic plugs**
Falsetti, L., Federal University of Sao Carlos (São Carlos, BR)

**03.40 PM** **Thermodynamic simulation of slag-refractory-interactions in different metallurgical systems**
Heikkinen, E., University of Oulu (Oulu, FI)

## IRONMAKING II

Chairs: Hennemann-Hohenfried, E., Refratechnik Steel GmbH (Bendorf, DE); Clasen, S., PAHAGE Feuerfeste Erzeugnisse GmbH & Co. KG (Viersen, DE)

PLATEAU 2

03.00 PM – 04.20 PM

**03.00 PM** **Improvement of $Al_2O_3$-SiC-C Bricks of the Hot Metal Ladle**
Hashimoto, K., Nippon Steel Corporation (Aichi Pref., JP)

**03.20 PM** **Improvement in torpedo ladle refractory corrosion rate by mist cooling**
Taniguchi, K., JFE Steel Corporation (Chiba, JP)

**03.40 PM** **Self-healing microstructure: the utmost refractory toughness mechanism**
Sako, E., Shinagawa Refractories Co., Ltd. (Vinhedo, BR)

**04.00 PM** **Recycling of $Al_2O_3$-SiC-C Refractory Brick for Repairing Torpedo Ladle Car**
Kim, S., Hyundai steel (Chungnam, KR)

# WEDNESDAY 27TH SEPTEMBER

## TESTING AND STANDARDIZATION II

Chairs: Klischat, H., World Refractories Association (Brussels, BE); Miranda, M., World Refractories Association (Brussels, BE)

MISTRAL

03.00 PM – 04.20 PM

**03.00 PM** **European and International Standardization Work in Refractories**
Baensch, F., Deutsches Institut für Normung (Berlin, DE)

**03.20 PM** **Young's Modulus of Refractories at High Temperatures: Comparison of different Testing Methods as Base for Masonry Modelling**
Tonnesen, T., RWTH Aachen University (Aachen, DE)

**03.40 PM** **Statistical Evaluation of influencing factors on various cold crushing strength determination methods**
Urbanek, G., RHI Magnesita (Leoben, AT)

**04.00 PM** **Evaluation of cold crushing strength methods on statistical values of various refractory brick grades**
Klischat, H., World Refractories Association (Brussels, BE)

## RAW MATERIALS – BINDERS I

Chairs: Kasper, J., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE); Schneider, N., Bakelite Synthetics (Iserlohn, DE)

MERIDIAN 2

03.00 PM – 04.00 PM

**03.00 PM** **Refractory cements containing Zr and Sr as alternatives to the CACs designed for the production of high performance monolithic refractories**
Madej, D., AGH University of Science and Technology (Krakow, PL)

**03.20 PM** **A new approach to achieve robust and easy to use NCC**
Lacoue, F., IMERYS (Paris, FR)

**03.40 PM** **What is really in there? Classification of aromatic compounds in carbon-based refractory bonds by high-resolution mass spectrometry and multivariate statistics**
Masoudi Alavi, A., University of Koblenz (Koblenz, DE)

## HYDROGEN II

Chairs: Sax, A., University of Koblenz (Koblenz, DE); Walls, P., Hitech Materials Pty Ltd (Figtree, AU)

HORIZONT

03.00 PM – 03.40 PM

**03.00 PM** **Status and challenges of hydrogen containing fuels on porous ceramic materials and protective systems in the energy industry**
Anton, R., Siemens Energy (Mülheim an der Ruhr, DE)

**03.20 PM** **$H_2$Change: Refractories under attack of challenging atmospheres during transformation process**
Sperber, J., STEULER-KCH GmbH (Höhr-Grenzhausen, DE)

# WEDNESDAY 27TH SEPTEMBER

## PANEL DISCUSSION – TRANSFORMATION OF THE STEEL INDUSTRY II: HYDROGEN RESISTANCE OF REFRACTORIES

Moderation: Tonnesen, T., RWTH Aachen University (Aachen, DE)

Kohnen, B., thyssenkrupp (Duisburg, DE); Anton, R., Siemens Energy (Berlin, DE); Sperber, J., Steuler Linings (Höhr-Grenzhausen, DE); Gavagnin, D., RHI Magnesita (Vienna, AT); Walls, P., Hitech Materials (Figtree, AUS); Li, H., Bao Steel Institute Luoyang (Luoyang, CN); Sax, A., University of Koblenz (Koblenz, DE)

HORIZONT

03.40 PM – 04.20 PM

Hydrogen will replace fossil fuels on the industry´s path towards carbon neutrality. It will be used as fuel, but also as reducing agent such as in direct reduced iron production. It is well known that hydrogen can attack refractories and destroy them over time, and which refractories are more or less prone to such attack. However, process conditions in new processes using hydrogen can differ from existing ones and research and testing are required in order to achieve the desired life time of refractories. An international group of experts from industry and research institutes will discuss this in a panel at UNITECR.

## MONOLITHIC REFRACTORIES II

Chairs: Holleyn, F., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE); Abdelouhab, S., Belgian Ceramic Research Centre (Mons, BE)

MERIDIAN 1

03.00 PM – 04.00 PM

**03.00 PM** **Dry high-performance materials in the change of time**
Damjanovič, B., EKW-Kremen d.o.o. (Šentjernej, SI)

**03.20 PM** **Hydrates regulation of CAC and their effects on high temperature properties of alumina-spinel castables**
Liao, N., Wuhan University of Science and Technology (Wuhan, CN)

**03.40 PM** **Use of Novel Refractory Design and Installation Techniques for Improved Energy Efficiency in Iron and Steel and Other Energy Intensive Industries**
Hemrick, J., Oak Ridge National Laboratory (Oak Ridge, US)

## POSTER SLAM

Chair: Aneziris, C. G., Technische Universität Bergakademie Freiberg (Freiberg, DE)

PLATEAU 1

04.40 PM – 05.15 PM

**04.40 PM** **Estimation of refractory castable thermal conductivity: a manufacturer's perspective**
Chang, C., China Ecotek Corporation (Kaohsiung, TW)

**04.41 PM** **Analysis of corrosion mechanisms of non-cement and low-cement alumina-magnesia gunning mix with special calcined alumina in rotary slag test**
Lee, Y., Hsin Lian Hsin Enterprise Co. Ltd. (Kaohsiung, TW)

# **WEDNESDAY** 27TH SEPTEMBER

**04.42 PM** **Ceramic foam filters with a carbon-bonded alumina coating for aluminum melt filtration**
Voigt, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)

**04.43 PM** **Formation of isolation layer between the refractory lining and molten steel/slag: Industrial trials in refining ladle**
Chen, J., Wuhan University of Science and Technology (Wuhan, CN)

**04.44 PM** **Refractory Handling Manipulator for safe & better ergonomics**
Ali, S., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**04.45 PM** **Improvement of thermo-mechanical properties of direct bonded magnesia chrome refractories for RH Degasser**
Ghosh, B., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**04.46 PM** **Performance improvement of steel ladle MgO-C refractories by using novel carbon additives**
Ghosh, B., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**04.47 PM** **Effect of firing temperature on thermo-mechanical properties of Low Cement Castables**
Samanta, A., TRL Krosaki Refractories Ltd. Gumadera (Belpahar, IN)

**04.48 PM** **Influence of Pitch Type on Properties of Blast Furnace Trough Castable**
Kanagawa, T., SHINAGAWA REFRACTORIES CO.,LTD (Okayama, JP)

**04.49 PM** **Understanding how the binder system influences the properties and process performance indicators of taphole clays**
Cameron, I., University of Pretoria (Pretoria, ZA)

**04.50 PM** **Modifications in Ladle Slide Gate System for improving Safety & Productivity**
Ali, S., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**04.51 PM** **Performance of Novel Silica Dry Vibrating Refractory Lining Mixes without pure Boric Acid or Boron Oxide in Crucible Induction Furnaces in the Iron Foundries**
Atanga, V., Dörentrup Feuerfestprodukte GmbH & Co. KG (Dörentrup, DE)

**04.52 PM** **Transmission conditions across a thin Thermoelastic interphase**
Pande, S., University of Trento (Trento, IT)

**04.53 PM** **Alumina/aluminum titanate based model refractory material: a promising microstructural design to enhance thermal shock resistance**
Mouiya, M., Département Science des Matériaux, Energie et Nano-ingénierie, Université Mohammed VI Polytechnique (UM6P) & Institut de Recherche sur les Céramiques (IRCER), Université de Limoges (Limoges, FR)

**04.54 PM** **Microstructure Design of a more Sustainable Alumina-spinel Refractory Castable**
Boateng, K., Imerys S.A. (Vaulx Milieu, FR)

**04.55 PM** **Discrete Element Method (DEM) to support microstructure design of refractories**
Ranganathan, H., Imerys Technology Center (Vaulx Milieu, FR)

**04.56 PM** **Hydrogen induced attack of $Al_2O_3$-$SiO_2$ refractories – application of SEM techniques and thermodynamics**
Henn, I., University of Koblenz (Koblenz, DE)

**04.57 PM** **Study on Chrome-free purging plug for steel ladles**
Klaus, S., Almatis GmbH (Frankfurt, DE)

# **WEDNESDAY** 27TH SEPTEMBER

**04.58 PM** **Online repairing of Blast furnace trough to enhance hot metal throughput**
Samanta, A., TRL Krosaki Refractories Ltd. Gumadera (Belpahar, IN)

**04.59 PM** **Design of Self-Flow castable using SioxX (TM) -Flow and its ageing analysis in tropical condition**
Mishra, A., Elkem South Asia Pvt. Ltd. (Nagapur, IN)

**05.00 PM** **Microstructural evolution and corrosion behavior of rebounded magnesia-chromite refractories used in steelmaking RH furnaces**
Bavand-Vandchali, M., Almas Alborz Refractories Co (Tehran, IR)

**05.01 PM** **Development of a novel thermal shock protocol of experiment of carbon-based refractory materials**
Anrhour, K., VESUVIUS, Trento University (Mons, BE)

**05.02 PM** **Advanced analytics applied to improve the energy efficiency of steel ladle logistics**
Ruela, V., Tata Steel, TU Wien (Uitgeest, NL)

**05.03 PM** **Carbon bonded rods for measurement of molten steel velocity at the meniscus level in the continuous caster mould: from the lab to the plant trials**
Luchini, B., Tata Steel Nederland (Velsen-Noord, NL)

**05.04 PM** **Approaches to solving advanced problems of established refractory designs in non-ferrous metallurgy**
Vezzuli, A., EKW Italia S.R.L. (Concorezzo, IT)

**05.05 PM** **Refractory composite aggregates based on Nb-$Al_2O_3$ using 3D printing technology**
Zienert, T., TU Bergakademie Freiberg (Freiberg, DE)

**05.06 PM** **The choice of magnesia-carbon refractories for steel ladle lining: a life cycle perspective**
Md Jubayed, University of Liege (Liege, BE)

**05.07 PM** **Characterization of refractories with regard to the application in $H_2$-containing atmospheres**
Bohorquez-Moreno, C., TataSteel, Montanuniversitat Leoben, (Velsen Noord, NL)

The jury will evaluate the 3 best presentations in terms of their successful short presentation. After a round of evaluation, the AWARD ceremony will take place at 6.00 PM.

The poster WALK will start directly after the AWARD ceremony. Refreshments and pretzel snacks will be served during the tour of the poster exhibition.

# WEDNESDAY 27TH SEPTEMBER

## IRONMAKING III

Chairs: Dey, R., Carborundum Universal Limited (Chennai, IN); Lemkamp, L., Hüttenwerke Krupp Mannesmann GmbH (Duisburg, DE)

PLATEAU 2

04.40 PM – 05.40 PM

**04.40 PM** **Refractory lining material in Iron Making Process – An overview with development and characterisation study of critical properties**
Dey, R., Carborundum Universal Limited (Chennai, IN)

**05.00 PM** **Traditional refractory designs replaced by innovative refractory solutions in hot blast stoves**
van Laar, F., Allied Mineral Technical Services LLC (Ancaster, CA)

**05.20 PM** **Post-mortem study on $Al_2O_3$-SiC-$SiO_2$-C castables used in the blast furnace runners**
Darban, S., Université de Toulouse (Toulouse, FR)

## TESTING AND STANDARDIZATION III

Chairs: Urbanek, G., RHI Magnesita (Leoben, AT); Baensch, F., Deutsches Institut für Normung (Berlin, DE)

MISTRAL

04.40 PM – 05.40 PM

**04.40 PM** **Bulk density determination of refractory raw materials – faster and better with a spin-dryer**
Buhr, A., Almatis (Frankfurt am Main, DE)

**05.00 PM** **Thermal conductivity: a modified high temperature panel method to speed up measures for lightweight and dense refractory materials**
Cappuzzo, S., Stazione Sperimentale del Vetro (Murano, IT)

**05.20 PM** **Characterization of inclusion populations in metal matrix using automated feature analysis**
Kerber, F., TU Bergakademie Freiberg (Freiberg, DE)

# WEDNESDAY 27TH SEPTEMBER

## MONOLITHIC REFRACTORIES III

Chairs: Simmat, R., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); Mix, M., Intocast AG (Ratingen, DE)

MERIDIAN 1

04.40 PM – 05.40 PM

**04.40 PM** **Influence of the type of phosphate additive on the setting kinetics of CA cement bonded refractory castables with special regard to the resulting pH value**
Kasper, J., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE)

**05.00 PM** **Influence of deflocculants on the hydrate phase formation and technological properties of CAC-bonded castables during the first heating process**
Noll, B., Koblenz University of Applied Sciences (Höhr Grenzhausen, DE)

**05.20 PM** **Impact of nano additives on the performance of low cement refractory castable**
Boris, R., Vilnius Gediminas technical university (Vilnius, LT)

## RAW MATERIALS – BINDERS II / SECONDARY MATERIALS I

Chairs: Sako, E., Shinagawa Refractories Co., Ltd. (Vinhedo, BR); Rebouillat, L., Pyrotek Inc, Mineral Processing (Drummondville, CA)

MERIDIAN 2

04.40 PM – 06.00 PM

**04.40 PM** **The Binding of non-cement refractory castables using the technology of Sol-Gel formation in situ**
Cichocki, M., Intocast AG (Krefeld, DE)

**05.00 PM** **What if we did not have to dry trough and runners castables anymore?**
Orsolini, H., SHINAGAWA REFRACTORIES CO., LTD (Valinhos, BR)

**05.20 PM** **Insights on numerical models to predict potential recyclability of spent refractories from steel making industry**
Salerno, A., Vesuvius, University of Limoges (Limoges, FR)

**05.40 PM** **Carbonized wood and sunflower seed hull pellets as a substitution for natural graphite for the production of MgO-C refractories**
Gehre, P., TU Bergakademie Freiberg (Freiberg, DE)

# WEDNESDAY 27TH SEPTEMBER

## HYDROGEN III

Chairs: Sperber, J., STEULER-KCH GmbH (Höhr-Grenzhausen, DE); Wetzig, T., Technische Universität Bergakademie Freiberg (Freiberg, DE)

HORIZONT

04.40 PM – 06.00 PM

**04.40 PM** **Switching to Hydrogen Based Fuels and their Effect on Refractory Linings and Processes**
Walls, P., Hitech Materials Pty Ltd (Figtree, AU)

**05.00 PM** **Phosphate-bonded refractories in hydrogen containing atmosphere**
Leber, T., RWTH University (Aachen, DE)

**05.20 PM** **Hydrogen corrosion of refractory minerals and the impact of SiO-gas**
Astoveza, J., IMERYS (Paris, FR)

**05.40 PM** **Physical properties of refractory bricks and changes of oxide materials after heat treatment at a hydrogen atmosphere**
Park, R., Chosun Refractories Co., Ltd (Pohang-si, KR)

## POSTER AWARD

Moderation: Prof. Dr. Christos G. Aneziris and Dr. Christian Dannert

Jury: Chris Parr (Imerys, Chair), Jens Sperber (STEULER), Karin Scharrer (refractories WORLDFORUM)

PLATEAU 1

06.00 PM – 06.20 PM

For details please see page 73.

## POSTER WALK

FOYER LEVEL 1

06.20 PM – 07.30 PM

For details please see page 73.

# THURSDAY
# 28TH SEPTEMBER

## » *QUICK TIPS*

# SCHEDULE THURSDAY 28TH SEPTEMBER

| | PLATEAU 1 | PLATEAU 2 | MISTRAL |
|---|---|---|---|
| 09.00 AM | **NON-FERROUS METALLURGY I**<br>09.00 AM – 10.40 AM P. 40 | **STEEL CASTING I**<br>09.00 AM – 10.40 AM P. 40 | **EDUCATION I**<br>09.00 AM – 10.40 AM P. 41 |
| 10.00 AM | | | |
| 11.00 AM | **NON-FERROUS METALLURGY II / FURNACES AND FOUNDRIES**<br>11.00 AM – 12.00 PM P. 43 | **EDUCATION II / MECHANISMS OF CORROSION, EROSION AND CLOGGING I**<br>11.00 AM – 12.20 PM P. 44 | **STEEL CASTING II**<br>11.00 AM – 12.20 PM P. 44 |
| 12.00 AM | | | |
| 01.00 PM | **CEMENT AND LIME I**<br>01.20 PM – 02.40 PM P. 46 | **MECHANISMS OF CORROSION, EROSION AND CLOGGING II**<br>01.20 PM – 02.40 PM P. 47 | **STEEL CASTING III**<br>01.20 PM – 02.40 PM P. 47 |
| 02.00 PM | | | |
| 03.00 PM | **CEMENT AND LIME II / CHEMICAL AND PETROCHEMICAL**<br>03.00 PM – 04.20 PM P. 49 | **MECHANISMS OF CORROSION, EROSION AND CLOGGING III / TESTING AND STANDARDIZATION IV**<br>03.00 PM – 04.20 PM P. 50 | **STEEL CASTING IV**<br>03.00 PM – 04.20 PM P. 50 |
| 04.00 PM | | | |
| 05.00 PM | **GLASS**<br>04.40 PM – 06.00 PM P. 53 | **SYNTHESIS OF MATERIALS I**<br>04.40 PM – 06.00 PM P. 53 | **STEEL CASTING V**<br>04.40 PM – 05.40 PM P. 54 |
| 06.00 PM | **CONFERENCE DINNER**<br>06.30 PM – 00.00 PM<br>Gesellschaftshaus Palmengarten, Palmengartenstrasse 11, 60325 Frankfurt am Main P. 17 | | |
| 07.00 PM | | | |

# SCHEDULE THURSDAY 28TH SEPTEMBER

| | MERIDIAN 1 | MERIDIAN 2 | HORIZONT |
|---|---|---|---|
| 09.00 AM | MONOLITHIC REFRACTORIES IV<br>09.00 AM – 10.40 AM P. 41 | SECONDARY METALLURGY I<br>09.00 AM – 10.40 AM P. 42 | RAW MATERIALS – SECONDARY MATERIALS II<br>09.00 AM – 10.00 AM P. 42 |
| 10.00 AM | | | PANEL DISCUSSION – RECYCLING OF REFRACTORIES<br>10.00 AM – 10.40 AM P. 43 |
| 11.00 AM | GUSTAV EIRICH AWARD<br>11.00 AM – 12.20 PM P. 44/71 | RAW MATERIALS – SECONDARY MATERIALS III<br>11.00 AM – 12.20 PM P. 45 | SECONDARY METALLURGY II<br>11.00 AM – 11.40 PM P. 45 |
| 12.00 AM | | | PANEL DISCUSSION – MONOLITHIC STEEL LADLE LINING<br>11.40 AM – 12.20 PM P. 46 |
| 01.00 PM | MONOLITHIC REFRACTORIES V<br>01.20 PM – 02.40 PM P. 48 | RAW MATERIALS – SECONDARY MATERIALS IV / SECONDARY METALLURGY III<br>01.20 PM – 02.40 PM P. 48 | DIGITALIZATION I<br>01.20 PM – 02.40 PM P. 49 |
| 02.00 PM | | | |
| 03.00 PM | DRYING AND HEATING OF MONOLITHIC REFRACTORIES I<br>03.00 PM – 04.20 PM P. 51 | SECONDARY METALLURGY IV<br>03.00 PM – 04.20 PM P. 51 | DIGITALIZATION II<br>03.00 PM – 03.40 PM P. 52 |
| 04.00 PM | | | PANEL DISCUSSION – MODELS AND DIGITALISATION IN INDUSTRIAL PRACTICE<br>03.40 PM – 04.20 PM P. 52 |
| 05.00 PM | TESTING OF MONOLITHIC REFRACTORIES I<br>04.40 PM – 06.00 PM P. 54 | SECONDARY METALLURGY V<br>04.40 PM – 06.00 PM P. 55 | DIGITALIZATION III<br>04.40 PM – 05.40 PM P. 55 |
| 06.00 PM | CONFERENCE DINNER<br>06.30 PM – 00.00 PM<br>Gesellschaftshaus Palmengarten, Palmengartenstrasse 11, 60325 Frankfurt am Main P. 17 | | |
| 07.00 PM | | | |

# THURSDAY 28TH SEPTEMBER

## NON-FERROUS METALLURGY I

Chairs: Cölle, D., EKW GmbH (Eisenberg, DE); Malczyk, P., Techische Universität Bergakademie Freiberg (Freiberg, DE)

PLATEAU 1

09.00 AM – 10.40 AM

**09.00 AM** **Flame-sprayed calcium aluminate-based coatings for application in the aluminium industry**
Gehre, P., TU Bergakademie Freiberg (Freiberg, DE)

**09.20 AM** **New Generation Castables – A Contribution to the discussion of $H_2$-assisted smelting furnaces for secondary aluminum**
Cölle, D., EKW GmbH (Eisenberg, DE)

**09.40 AM** **Comparative post-mortem research on the corrosion resistance of chemically bonded castables in contact with molten aluminum**
Madej, D., AGH University of Science and Technology (Krakow, PL)

**10.00 AM** **Steel Ceramic Composites resistant to long-term contact with Molten Aluminum Alloys**
Malczyk, P., Techische Universität Bergakademie Freiberg (Freiberg, DE)

**10.20 AM** **Influence of filter surface roughness on the pressure drop of ceramic foam filters**
Voigt, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)



## STEEL CASTING I

Chairs: Karrasch, S., Thyssenkrupp Steel Europe AG (Duisburg, DE); Kreuels, M., Weerulin GmbH (Mülheim an der Ruhr, DE)

PLATEAU 2

09.00 AM – 10.40 AM

**09.00 AM** **Effect of Tundish Plate Refractory Erosion on Steel Quality and Development of Erosion Measurement System**
Kim, J., POSCO (Jeollanam-do, KR)

**09.20 AM** **Mineralogical features of tundish MgO-spray and their influence on the reoxidation of Al-killed steel**
Loison, L., ArcelorMittal Maizières Research (Maizières-les-Metz, FR)

**09.40 AM** **The influence of Ca, Na-, and P-content of MgO-based resin-free vibrateable dry tundish linings on the population of non-metallic inclusions in a steel melt**
Veres, D., TU Bergakademie Freiberg (Freiberg, DE)

**10.00 AM** **Reduction of large inclusions in billets by improving the cleanliness of tundish molten steel**
Lee, J., Hyundai steel (Korea, KR)

**10.20 AM** **Deterioration mechanism of $Al_2O_3$-MgO refractory castable in RH refining ladle**
Chen, J., Wuhan University of Science and Technology (Wuhan, CN)

# THURSDAY 28TH SEPTEMBER

## EDUCATION I

Chairs: Poirier, J., University of Orleans (Orleans, FR); de Bilbao, E., CEMHTI UPR 3079 CNRS, Université d'Orléans (Orleans, FR)

MISTRAL

09.00 AM – 10.40 AM

**09.00 AM** **Reimagining refractories: How professional societies influence the perception of refractory technology and engineering**
De Guire, E., The American Ceramic Society (Westerville, OH, US)

**09.20 AM** **On Refractory Engineering Education Evolution**
Rigaud, M., École Polytechnique-Montréal, (Westmount, Qc., CA)

**09.40 AM** **EU ATHOR project (2017-2022) – Direct impacts on international refractory community**
Huger, M., IRCER, University of Limoges (Limoges, FR)

**10.00 AM** **EU CESAREF project (2022-2026) – A coming contribution to European Green Deal**
Huger, M., IRCER, University of Limoges (Limoges, FR)

**10.20 AM** **Exploration and practice of international education for refractory specialty in WUST**
Huang, A., Wuhan University of Science and Technology (Wuhan, CN)

## MONOLITHIC REFRACTORIES IV

Chairs: Brochen, E., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); Podwórny, J., Łukasiewicz – Institute of Ceramics and Building Materials (Gliwice, PL)

MERIDIAN 1

09.00 AM – 10.40 AM

**09.00 AM** **A holistic view and benefits based on a planned CFB boiler castable lining design**
A L Braulio, M., 4CAST (São Carlos, BR)

**09.20 AM** **Influence of Sintering Additives and Sol-Gel Bonding Agents on Workability and Flexural Strength of Cement Free Castables**
Ibarra Plata, L., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**09.40 AM** **Steel ladle lining management: comparison between different maintenance technologies to increase performance, reduce refractory consumption and waste disposal of used materials**
Kranjc, A., Seven Refractories d.o.o. (Divača, SI)

**10.00 AM** **High Temperature Innovative Zirconia-alumina Ramming Mass**
Martynenko, V., Ukrainian Research Institute of Refractories named after A.S. Berezhnoy (Kharkiv, UA)

**10.20 AM** **Development of Cement Free Dry-Gunning Mix and Its Application to Actual Furnaces**
Takeuchi, S., MINO CERAMIC CO., LTD. (Kamezakikitaura-cho, Handa-shi, Aichi, JP)

# THURSDAY 28TH SEPTEMBER

## SECONDARY METALLURGY I

Chairs: Schmidtmeier, D., Almatis GmbH (Ludwigshafen, DE); Neese, J., Refratechnik Steel GmbH (Düsseldorf, DE)

MERIDIAN 2

09.00 AM – 10.40 AM

**09.00 AM** **The effect of MgO-C refractory materials on the inclusion population within steel**
Kerber, F., TU Bergakademie Freiberg (Freiberg, DE)

**09.20 AM** **A novel member in the CMA-family of aggregates creating more sustainable A-MA steel ladle refractories**
Wöhrmeyer, C., IMERYS (Oberhausen, DE)

**09.40 AM** **Castable matrix concept for robust behaviour in steel ladle bottom repair**
Rojek, G., ArcelorMittal Refractories (Kraków, PL)

**10.00 AM** **Application of Unburned Magnesia Bricks for Steel Secondary Refining Processes**
Tomita, Y., Krosaki Harima Corporation (Kitakyushu, JP)

**10.20 AM** **Application of high-calcium magnesia in ladle brick and its purification effect on molten steel**
LIU, C., Puyang Refractories Group Co., Ltd (PRCO) (Puyang, CN)

## RAW MATERIALS – SECONDARY MATERIALS II

Chairs: Schöttler, L., Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG (Siegen, DE); Tanasic, N., Horn & Co. Group (Siegen-Weidenau, DE)

HORIZONT

09.00 AM – 10.00 AM

**09.00 AM** **Squaring the Circle: Challenges & Opportunities in Recycling Refractory Minerals**
O'Driscoll, M., IMFORMED (Epsom, GB)

**09.20 AM** **Latest advanced developments in the implementation of Circular Economy strategy in the refractory waste management**
Soto, A., Sidenor I+D (Basauri, ES)

**09.40 AM** **Establishing circular economy for refractories in cement applications by advanced recycling technologies**
Königshofer, S., RHI Magnesita GmbH (Leoben, AT); Geith, M., RHI Magnesita GmbH (Leoben, AT)

**BE THERE**
**GUSTAV EIRICH AWARD**

11.00 AM – 12.20 PM
MERIDIAN 1

To promote ideas and, at the same time, to support young talents in technical disciplines.

→ PAGE 71

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# THURSDAY 28TH SEPTEMBER

## PANEL DISCUSSION – RECYCLING OF REFRACTORIES

Moderation: Schöttler, L., Deutsche Edelstahlwerke Specialty Steel (Siegen, DE)

Siebring, R., Tata Steel (IJmuiden, NL); Jansen, H., Refratechnik Steel (Düsseldorf, DE); Zettl, K.-M., RHI Magnesita (Vienna, AT); Tanasic, N., Mireco (Siegen-Weidenau, DE); O`Driscoll, M., IMFORMED (Epsom, UK)

HORIZONT

10.00 AM – 10.40 AM

Recycling of refractories is important to conserve limited resources and reduce the carbon and ecological footprint in the refractory industry. For recycling of refractories, efficient reclaiming technology but also lining concepts taking the reclaiming already into account are as important as to overcome the perception that refractories containing recycle material automatically would mean worse quality or performance. An international group of experts from the industries will discuss this in a panel at UNITECR.

## NON-FERROUS METALLURGY II / FURNACES AND FOUNDRIES

Chairs: Moritz, K., Technische Universität Bergakademie Freiberg (Freiberg, DE); Szczerba, J., AGH University of Science and Technology (Kraków, PL)

PLATEAU 1

11.00 AM – 12.00 PM

**11.00 AM** **Interactions between the gas phase in a nickel flash smelting furnace and the refractory lining**
Lindgren, M., Metso Outotec (Pori, FI)

**11.20 AM** **$Al_2O_3$-$MgAl_2O_4$ refractory material as a Cr-free alternative dedicated to the copper industry**
Jastrzębska, I., AGH University of Science and Technology (Kraków, PL)

**11.40 AM** **The influence of alumina type on corrosion resistance of smart $Al_2O_3$-MgO monolithic refractories used in crucible induction furnaces**
Bavand-Vandchali, M., Almas Alborz Refractories Co (Tehran, IR)

# THURSDAY 28TH SEPTEMBER

## EDUCATION II / MECHANISMS OF CORROSION, EROSION AND CLOGGING I

Chairs: Huger, M., IRCER, University of Limoges (Limoges, FR); Rigaud, M., École Polytechnique-Montréal, (Westmount, Qc., CA)

PLATEAU 2

11.00 AM – 12.20 PM

**11.00 AM** **From unpopular matter to smart subject: public funding of refractory research and PhD education by DFG research programs at TU Freiberg**
Gehre, P., TU Bergakademie Freiberg (Freiberg, DE)

**11.20 AM** **Bachelor of ceramic science (Dual) at Koblenz University of Applied Science – an opportunity for the industry to overcome skills shortage**
Krause, O., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**11.40 AM** **Effect of the impregnation with liquid glass on the properties of refractory castable**
Malaiškienė, J., Vilnius Gediminas technical university (Vilnius, LT)

**12.00 PM** **Numerical Analysis of Molten Steel Infiltration in Porous Bricks**
Matsumoto, S., Krosaki Harima Corporation (Kitakyushu City, JP)

## STEEL CASTING II

Chairs: Malczyk, P., Techische Universität Bergakademie Freiberg (Freiberg, DE); Helmus, D., Knöllinger Keramische Verschleißteile GmbH (Hillscheid, DE)

MISTRAL

11.00 AM – 12.20 PM

**11.00 AM** **Development of unfired and non-impregnated slide gate plates as a contribution to reducing emissions of carbon bonded refractories**
Helmus, D., Knöllinger Keramische Verschleißteile GmbH (Hillscheid, DE)

**11.40 AM** **The effect of selected metallic additives on the properties of the $Al_2O_3$-C refractory material**
Świerszcz, R., Zakłady Magnezytowe "ROPCZYCE" S.A. (Ropczyce, PL)

**12.00 PM** **Effect of recycled materials from isostatic pressing products on the strength of $Al_2O_3$-C refractory and improvement measures**
Pan, L., Puyang Refractories Group Co., Ltd. (Puyang, CN)

## GUSTAV EIRICH AWARD

MERIDIAN 1

11.00 AM – 12.20 PM

Prizegiving for the three best dissertations (Ph.D. theses) in the field of refractories, and lectures (20 minutes each) from the three winners..

For details please see page 71.

# THURSDAY 28TH SEPTEMBER

## RAW MATERIALS – SECONDARY MATERIALS III

Chairs: Dannert, C., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); O'Driscoll, M., IMFORMED (Epsom, GB)

MERIDIAN 2

11.00 AM – 12.20 PM

**11.00 AM** **Investigation of the influence of impurities typical in secondary raw materials on the behavior of high alumina castables – Part I: design of the castables, setting properties and high temperature fracture behavior**
Erbar, L., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**11.20 AM** **Investigation of the role of impurities typical in secondary raw materials on the behaviour of high alumina castables – Part II: Influence on thermomechanical behaviour**
Podwórny, J., Łukasiewicz – Institute of Ceramics and Building Materials (Gliwice, PL)

**11.40 AM** **The Properties of MgO-C refractories with a new recycled MgO-C raw material**
Lee, T., POSCO CHEMICAL (Pohang, KR)

**12.00 PM** **Technical challenges for recycling processing and utilization ramp-up**
Naves Moraes, M., RHI Magnesita (Belo Horizonte, BR)

## SECONDARY METALLURGY II

Chairs: Zobec, E., Seven Refractories d.o.o. (Divača, SI); Viertauer, A., Mayerton Refractories Ltd (Solihull, GB)

HORIZONT

11.00 AM – 11.40 AM

**11.00 AM** **Steel ladle: capacity increase, lining concepts and recycling experience over 25 years**
Exenberger, R., voestalpine Stahl GmbH (Linz, AT)

**11.20 AM** **ECO-TAB – A new alumina aggregate for steel ladle lining**
Klaus, S., Almatis GmbH (Frankfurt, DE)

# THURSDAY 28TH SEPTEMBER

## PANEL DISCUSSION – MONOLITHIC STEEL LADLE LINING

Moderation: Buhr, A., Almatis (Frankfurt, DE)

Exenberger, R., voestalpine Linz (Linz, AT); Vatanen, J., SSAB Raahe (Raahe, FI); Shepherd, R., thyssenkrupp (Duisburg, DE); Zobec, E., Seven Refractories (Divača, SI); Mix, M., Intocast (Ratingen, DE); Schwan, M., Mapeko (Neuwied, DE)

HORIZONT
11.40 AM – 12.20 PM

Monolithic lining concepts with relining technology achieve the lowest specific material consumption possible in steel ladles. In addition, carbon-free alumina-spinel materials reduce thermal losses and enable energy saving in the process. However, in spite of these advantages the monolithic steel ladle lining has not yet become the dominant lining technology in Europe or America, other than in Japan. An international group of experts from the steel and the refractory industries will discuss experiences, perceptions, and important topics for implementation of the technology in a panel at UNITECR.

## CEMENT AND LIME I

Chairs: Klischat, H., Refratechnik Cement GmbH (Göttingen, DE); Sarioglu, N., KUMAS Manyezit Sanayi A.Ş. (Kutahya, TR)

PLATEAU 1
01.20 PM – 02.40 PM

**01.20 PM** **Challenges for a Cement Producer**
Wagner, V., HeidelbergCement AG (Heidelberg, DE)

**01.40 PM** **Near-customer engineering management for advanced applications in the cement industry**
Vesenberg, B., EKW GmbH (Eisenberg, DE)

**02.00 PM** **Effective $CO_2$-Reduction for Rotary Kiln Burning Processes by Using Energy Efficient Linings**
Klischat, H., Refratechnik Cement GmbH (Göttingen, DE)

**02.20 PM** **Energy-saving Refractory Bricks for Sustainable Lining of Rotary Kilns**
Akkasoglu, U., KUMAS Manyezit Sanayi A.Ş. (Kutahya, TR)

# THURSDAY 28TH SEPTEMBER

## MECHANISMS OF CORROSION, EROSION AND CLOGGING II

Chairs: Krause, O., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE); Erbar, L., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

PLATEAU 2

01.20 PM – 02.40 PM

**01.20 PM** **CaO attack on refractory materials of the system $SiO_2$-$Al_2O_3$**
Weber, K., Refratechnik Cement GmbH (Göttingen, DE)

**01.40 PM** **Impact of hydrogen on carbon monoxide disintegration of refractories**
Liefhebber, J., Tata Steel Nederland (IJmuiden, NL)

**02.00 PM** **Knowledge about the Carbon Deposition in the Microstructure of Refractory Materials**
Koch, A., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**02.20 PM** **The influence of the gas permeability of refractory materials on carbon deposition in CO containing atmospheres**
Steffen, T., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE)

## STEEL CASTING III

Chairs: Trummer, B., RHI Magnesita GmbH (Vienna, AT); Bogan, J., HarbisonWalker International (West Mifflin, USA)

MISTRAL

01.20 PM – 02.40 PM

**01.20 PM** **Prevention of Abnormal Damage of CaO-$ZrO_2$-C for Submerged Entry Nozzles**
Lin, W., Shinagawa Refractories Co., Ltd. (Bizen, JP)

**01.40 PM** **Development and implementation of holistic approach to address clogging phenomena in continuous casting of steel for Vesuvius flow control customer**
Fallah-Mehrjardi, A., VESUVIUS (Ghlin, BE)

**02.00 PM** **Submerged Entry Nozzle preheating effect on its permeability**
de Bilbao, E., CEMHTI UPR 3079 CNRS, Université d'Orléans (Orleans, FR)

**02.20 PM** **Simulating methods for $Al_2O_3$ cloggings on SEN**
Liu, G., Sinosteel Luoyang Institute of Refractories Research Co., Ltd. (Henan, CN)

# THURSDAY 28TH SEPTEMBER

## MONOLITHIC REFRACTORIES V

Chairs: Kasper, J., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE); Parr, C., Imerys (Lyon, FR)

MERIDIAN 1

01.20 PM – 02.20 PM

**01.20 PM** **How the composition of self-flowing refractory castables influences their rheological properties**
Bastian, M., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE)

**01.40 PM** **Development of a printable alumina-based composition of refractory castable for 3D printing preshaped parts**
Abdelouhab, S., Belgian Ceramic Research Centre (Mons, BE)

**02.00 PM** **Adaptation of the contour-crafting process to refractories and investigation of material properties after the 3D printing process**
Holleyn, F., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

## RAW MATERIALS – SECONDARY MATERIALS IV / SECONDARY METALLURGY III

Chairs: Jansen, H., Refratechnik Steel GmbH (Düsseldorf, DE); Li, H., Sinosteel Luoyang Institute of Refractories Research Co., Ltd. (Luoyang, Henan, CN)

MERIDIAN 2

01.20 PM – 02.40 PM

**01.20 PM** **Recyclate-containing magnesia-carbon refractories – Influence on the non-metallic inclusions in steel**
Moritz, K., Technische Universität Bergakademie Freiberg (Freiberg, DE)

**01.40 PM** **Effect of Different Carbon Sources on Ultra Low Carbon Bricks for Steel Applications**
Cabral Silva, S., RHI Magnesita (Contagem, BR)

**02.00 PM** **Unfired Zero C Brick for Energy Savings and Performance Increasing of Metal Line for Steel Ladle**
Pagliosa, C., RHI Magnesita (Contagem, BR)

**02.20 PM** **Improved slag corrosion resistance of MgO–C refractories for ladle slag line**
Zhu, T., Wuhan University of Science and Technology (Wuhan, CN)

# THURSDAY 28TH SEPTEMBER

## DIGITALIZATION I

Chairs: Siebring, R., Tata Steel (IJmuiden, NL); Dannert, C., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE)

HORIZONT

01.20 PM – 02.40 PM

**01.20 PM** **Artificial Intelligence (AI) for supporting useful life and thickness estimation of the refractory bricks of the ladle lining in steelmaking**
Arostegi, M., Tecnalia Research & Innovation (Derio Bizkaia, ES)

**01.40 PM** **Artificial Intelligence applied to enhance the thermal management of torpedo ladle cars**
Garcia Campos, M., Tata Steel Nederland (IJmuiden, NL)

**02.00 PM** **The use of numerical modelling for refractories optimisation in the reheating furnaces at Tata Steel Nederland**
van Sikkelerus, F., Tata Steel Nederland (IJmuiden, NL)

**02.20 PM** **A new standard from WRA for digital exchange of refractories data**
Platzer, A., RHI Magnesita (Radenthein, AT)

## CEMENT AND LIME II / CHEMICAL AND PETROCHEMICAL

Chairs: Reif, G., RHI Magnesita (Leoben, AT); Klischat, H., Refratechnik Cement GmbH (Göttingen, DE)

PLATEAU 1

03.00 PM – 04.20 PM

**03.00 PM** **Customized Linings for Upper Transition Zones of Rotary Kilns for Contemporary Cement Clinker Production Conditions**
Wirsing, H., Refratechnik Cement GmbH (Göttingen, DE)

**03.20 PM** **Refractory Linings for Cement Rotary Kilns Contributing to Environmental Impact Reduction**
Ohno, M., MINO CERAMIC CO., LTD. (Handa-shi, Aichi, JP)

**03.40 PM** **Premature refractory lining integrity deterioration in a syn-gas reforming furnace**
Manabendra, Maity, Saudi Basic Industries Corporation (SABIC) (Jubail, Saudi Arabia)

**04.00 PM** **Refractory Lining Condition Assessment and Integrity Management of Hydrocarbon Process Furnaces and Reactors**
Manabendra, Maity, Saudi Basic Industries Corporation (SABIC) (Jubail, Saudi Arabia)

# THURSDAY 28TH SEPTEMBER

## MECHANISMS OF CORROSION, EROSION AND CLOGGING III / TESTING AND STANDARDIZATION IV

Chairs: Voigt, C., Technische Universität Bergakademie Freiberg (Freiberg, DE); Gasser, A., University of Orléans (Orléans, FR)

PLATEAU 2

03.00 PM – 04.00 PM

**03.00 PM** **Exceptional "Highlights" of extreme Wear of Refractories**
Neese, J., Refratechnik Steel GmbH (Düsseldorf, DE)

**03.20 PM** **Improving the refractories selection regarding their thermal shock resistance (TSR) by using practice-oriented investigations promoting experimental thermal loading close to their service conditions**
Brochen, E., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE)

**03.40 PM** **Thermal Shock Resistance of Alumina Foam Filters - a Comparative Study**
Gumban, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)

## STEEL CASTING IV

Chairs: Lüftenegger, A., Vesuvius Plc (London, GB); Kitazawa, Y., Krosaki Harima Corporation (Kitakyushu, JP)

MISTRAL

03.00 PM – 04.00 PM

**03.00 PM** **Evaluation of oxide-based SEN and oxide-less SEN on Nozzle Clogging**
Kim, M., Chosun Refractories Co,. Ltd (Pohang City, KR)

**03.20 PM** **Journey of "Thin Slab SEN" Performance improvement, to become benchmark for Global CSP Caster**
Ali, S., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**03.40 PM** **Casting of CaFe treated steel and its effect on recrystallization and lifetime of $ZrO_2$ metering nozzles**
Bahrami Samani, M., Mehrgodaz Refractories Company (Sefiddasht, Chaharrmahal and Bakhtiari, IR)

# THURSDAY 28TH SEPTEMBER

## DRYING AND HEATING OF MONOLITHIC REFRACTORIES I

Chairs: Tonnesen, T., RWTH Aachen University (Aachen, DE); Shukla, D., VESUVIUS (Barlborough, GB)

MERIDIAN 1

03.00 PM – 04.20 PM

**03.00 PM** **Online drying monitoring system for refractory castbles**
Stein, T., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**03.20 PM** **Permeability-Enhancing Drying Additives – A Perspective from in-situ Analysis**
Moreira, M., Federal University of São Carlos (Sao Carlos, BR)

**03.40 PM** **Practical experimentation and model development for the drying of monolithic refractory castables**
Lambert, M., Allied Mineral Products, LLC (Columbus, OH, US)

**04.00 PM** **Analysis of weep hole efficiency in steel ladles via computational simulations**
Moreira, M., Federal University of São Carlos (Sao Carlos, BR)

## SECONDARY METALLURGY IV

Chairs: Mix, M., Intocast AG (Ratingen, DE); Loison, L., ArcelorMittal Maizières Research (Maizières-les-Metz, France)

MERIDIAN 2

03.00 PM – 04.20 PM

**03.00 PM** **Interaction of molten secondary metallurgical ladle slag with MgO-C refractories**
Yehorov, A., TU Bergakademie Freiberg (Freiberg, DE)

**03.20 PM** **High Durability Ladle Treatment (LT) Lance for Steel Secondary Refining**
Yamada, K., Krosaki Harima Corporation (Kitakyushu City, JP)

**03.40 PM** **Graphene added Carbon MgO-C for Slag zone in steel ladle**
Ghosh, G., Tata Steel (Jamshedpur, IN); Panigrahi, P., Tata Steel (Jamshedpur, IN)

**04.00 PM** **Effects of Calcium Magnesium Aluminate Binder on Properties of Alumina-Magnesia Castables for Steel Ladle**
Chen, K., China Steel Corporation (Kaohsiung, TW)

# THURSDAY 28TH SEPTEMBER

## DIGITALIZATION II

Chairs: van Beurden, P., Tata Steel (IJmuiden, NL); Tomas, M., RHI Magnesita GmbH (Vienna, AT)

HORIZONT

03.00 PM – 03.40 PM

**03.00 PM** **Converter on life-support: A structured approach to determine the governing parameters of refractory wear to stabilise and prolong the lining lifetime**
Vermeulen, F., Tata Steel (IJmuiden, NL)

**03.20 PM** **Into the Unknown: Explaining and predicting slag line wear based on process parameters**
Gil, A., Tata Steel (IJmuiden, NL)

## PANEL DISCUSSION – MODELS AND DIGITALISATION IN INDUSTRIAL PRACTICE

Moderation: Siebring, R., Tata Steel (IJmuiden, NL)

van Beurden, P., Tata Steel (IJmuiden, NL); Schwarz, M., Deutsche Edelstahlwerke (Siegen, DE); Tomas Casado, M., RHI Magnesita (Rotterdam, NL); Platzer, A., RHI Magnesita (Radenthein, AT), Romero Baivier, S., Vesuvius (Lille, FR)

HORIZONT

03.40 PM – 04.20 PM

The refractory and its user industries are still very often driven by trial and error, which inherently leads to too long development cycles for new approaches. Modelling and digitalised data analysis can contribute to faster innovation which is needed to overcome the carbon challenge. An international group of experts will discuss in a panel at UNITECR which data are available or would be required, how to approach data exchange between suppliers and users of refractories, and what has been achieved so far.

# THURSDAY 28TH SEPTEMBER

## GLASS

Chairs: Postrach, S., RHI Magnesita (Wiesbaden, DE); Kunert, C., SCHOTT AG (Mainz, DE)

PLATEAU 1

04.40 PM – 06.00 PM

**04.40 PM** **Fused Silica – The answer to challenging furnace conditions**
Dietrich, M., RHI Glas GmbH (Wiesbaden, DE)

**05.00 PM** **Comparison of two conventional and containerless solidified fused cast AZS materials**
Niessen, J., RWTH Aachen University (Aachen, DE)

**05.20 PM** **Study of the evolution in temperature of mechanical properties and consolidation of a refractory**
Bigeard, A., Saint-Gobain Research Provence (Cavaillon, FR)

**05.40 PM** **Fused cast AZS blocks and their mineral phases after production, after annealing the furnace and in use**
Fleischmann, B., Hüttentechnische Vereinigung der Deutschen Glasindustrie (HVG) e.V. (Offenbach, DE)

## SYNTHESIS OF MATERIALS I

Chairs: Kerber, F., TU Bergakademie Freiberg (Freiberg, DE); Wöhrmeyer, C., IMERYS (Oberhausen, DE)

PLATEAU 2

04.40 PM – 06.00 PM

**04.40 PM** **MgO-C refractories based on refractory recyclates and environmentally friendly binders**
Stadtmüller, T., Technische Universität Bergakademie Freiberg (Freiberg, DE)

**05.00 PM** **The Role of Andalusite in Refractory Castables and possible Substitutions – Part 1: Thermal behaviour of Andalusite bearing Castables**
Simmat, R., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE)

**05.20 PM** **The Role of Andalusite in Refractory Castables and possible substitutions – Part 2: Changes in Ceramic Structure During Heat-Up**
Paul, J., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**05.40 PM** **The Role of Andalusite in Refractory Castables and possible substitutions – Part 3: First attempt to redesign required properties within the parameters of andalusite free castables**
Abdelgawad, K., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

# THURSDAY 28TH SEPTEMBER

## STEEL CASTING V

Chairs: Kirill, A., Vesuvius R&D (Ghlin, BE)

MISTRAL

04.40 PM – 05.40 PM

**04.40 PM** **The development of insulation coating**
Koide, W., TYK Corporation (Ena-City, Gifu Pref., JP)

**05.00 PM** **Yttria magnesia co-stabilized zirconia refractories for application as functional components in continuous steel casting**
Heuer, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)

**05.20 PM** **Extruded cellular filter components for steel melt filtration in industrial continuous casting of steel**
Wetzig, T., Technische Universität Bergakademie Freiberg (Freiberg, DE)

## TESTING OF MONOLITHIC REFRACTORIES

Chairs: Quirmbach, P., University of Koblenz (Koblenz, DE); Klaus, S., Almatis GmbH (Frankfurt, DE)

MERIDIAN 1

04.40 PM – 06.00 PM

**04.40 PM** **New method for the determination of the dynamic viscosity of castables**
Bastian, M., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE)

**05.00 PM** **Rheology of refractory castables – Part 1: A novel 3D spread flow measuring device allows to determine more precisely the workability of refractory castables**
Krause, O., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**05.20 PM** **Thermo-mechanical behavior of alumina-magnesia castables and its lining lifetime simulation**
Dai, Y., Wuhan University of Science and Technology (Wuhan, CN)

**05.40 PM** **Rheology of refractory castables – Part 2: Influence of the mixing energy input in terms of mixing time and velocity on the spread measured with a new 3D-Spread-flow device with special regard towards the ambient working conditions.**
Kakavand, M., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

# THURSDAY 28TH SEPTEMBER

## SECONDARY METALLURGY V

Chairs: Volkova, O., TU Bergakademie Freiberg (Freiberg, DE); Mishra, N., RHI Magnesita India (Bhiwadi, IN)

MERIDIAN 2

04.40 PM – 06.00 PM

**04.40 PM** **Chrome Free Baked Magnesia Brick – A Really Environmentally Friendly Product for RH Degassers**
Ramos, V., Shinagawa Refractories Co., Ltd (Vinhedo, BR)

**05.00 PM** **Effect of special carbon additive on the properties of dolomite-carbon refractories for steel ladle application**
Samanta, A., TRL Krosaki Refractories Ltd. Gumadera (Belpahar, IN)

**05.20 PM** **Improving the quality and productivity of steel by using quicklime surface treated with silicone oil**
Shin, G., POSCO CHEMICAL (Sinhang-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, KR)

**05.40 PM** **Improved comprehensive properties of $Al_2O_3$-MgO-C refractories containing lightweight tabular alumina aggregates**
Chen, Q., Puyang Refractories Group Co., Ltd. (PRCO) (Puyang, CN)

## DIGITALIZATION III

Chairs: Schemmel, T., Refratechnik Steel GmbH (Düsseldorf, DE); Sinnema, S., Tata Steel Nederland (IJmuiden, NL)

HORIZONT

04.40 PM – 05.40 PM

**04.40 PM** **Refractory Performance Tracking: from materials development to application monitoring**
Dos Santos, M., Federal University of São Carlos (Sao Carlos, BR)

**05.00 PM** **Application of Machine Learning in the assessment of the wear rate of MgO-C refractory materials dedicated for steel industry**
Sado, S., Zakłady Magnezytowe "ROPCZYCE" S.A. (Warsaw, PL)

**05.20 PM** **Experimental and numerical investigation of a pilot steel ladle**
Gajjar, P., University of Minho (Guimaraes, PT)

## CONFERENCE DINNER

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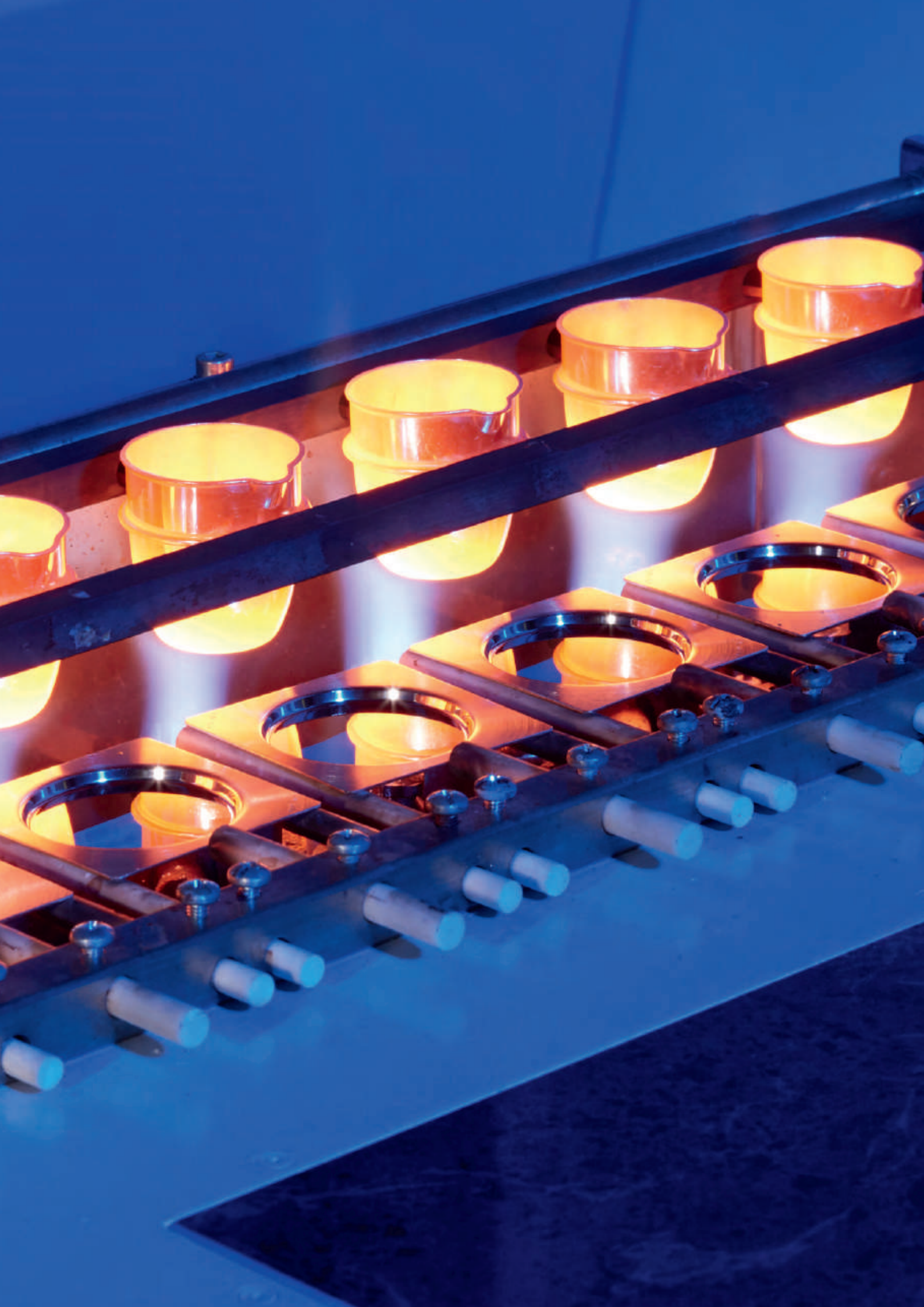
06.30 PM – 00.00 PM

For details please see page 17



# FRIDAY
29TH SEPTEMBER

## ⟫ *QUICK TIPS*

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# SCHEDULE FRIDAY 29TH SEPTEMBER

| | PLATEAU 1 | PLATEAU 2 | MISTRAL |
|---|---|---|---|
| 09.00 AM | ENERGY & WASTE INCINERATION I<br>09:00 AM – 10:40 AM P. 60 | SYNTHESIS OF MATERIALS II<br>09:00 AM – 10:40 AM P. 60 | ENGINEERING OF REFRACTORIES<br>09:00 AM – 10:20 AM P. 61 |
| 10.00 AM | | | |
| 11.00 AM | | SYNTHESIS OF MATERIALS III<br>11:00 AM – 12:20 PM P. 63 | INNOVATION IN REFRACTORY APPLICATIONS<br>11:00 AM – 12:20 PM P. 63 |
| 12.00 AM | | | |

| | MERIDIAN 1 | MERIDIAN 2 | HORIZONT |
|---|---|---|---|
| 09.00 AM | DRYING AND HEATING OF MONOLITHIC REFRACTORIES II<br>09:00 AM – 10:40 AM P. 61 | RAW MATERIALS – ALUMINA MATERIALS I<br>09:00 AM – 10:40 AM P. 62 | PRIMARY METALLURGY II<br>09:00 AM – 10:40 AM P. 62 |
| 10.00 AM | | | |
| 11.00 AM | DRYING AND HEATING OF MONOLITHIC REFRACTORIES III<br>11:00 AM – 12:20 PM P. 64 | RAW MATERIALS – OTHER MATERIALS<br>11:00 AM – 12:00 PM P. 64 | PRIMARY METALLURGY III<br>11:00 AM – 12:40 PM P. 65 |
| 12.00 AM | | | |

# PROCEEDINGS

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# FRIDAY 29TH SEPTEMBER

## ENERGY & WASTE INCINERATION I

Chairs: Touzo, B., Calderys (Neuwied, DE); Postrach, S., RHI Magnesita (Wiesbaden, DE)

PLATEAU 1

09.00 AM – 10.40 AM

**09.00 AM** **Development of a high-temperature-TES system using refractory materials for long-term storage of renewable energy**
Hennemann-Hohenfried, E., Refratechnik Steel GmbH (Bendorf, DE)

**09.20 AM** **The influence of firing parameters on the formation of nitride phases in nitride bonded silicon carbides**
Kehren, J., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE)

**09.40 AM** **Development of high SiC fraction refractories with silica sol binder**
Goto, H., Calderys Japan Co., Ltd (Yoshibora, Shidare-cho, Toyota, Aichi, JP)

**10.00 AM** **A major step towards the replacement of chromium oxide in refractories for incinerators and other applications**
Soth, R., IMERYS (Paris, FR)

**10.20 AM** **Oxidation behaviors and mechanisms of SiC refractory materials used in municipal waste incinerators containing anti-oxidizing additives**
Lang, C., BCRC (Mons, BE)



## SYNTHESIS OF MATERIALS II

Chairs: Salvini, V., Federal University of São Carlos (São Carlos, BR); Heuer, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)

PLATEAU 2

09.00 AM – 10.40 AM

**09.00 AM** **Refractory ink-coated porous insulators to prevent microwave plasma discharges for high-temperature microwave heating**
Ferreira Cardoso, A., Federal University of São Carlos (São Carlos, BR)

**09.20 AM** **High-temperature damage and mechanical behavior of niobium-alumina refractory composites under compression and bending**
Günay, G., TU Bergakademie Freiberg (Freiberg, DE)

**09.40 AM** **Comparison of solidification behavior of synthetic mullite and mullite-forming raw materials by aero-acoustic levitation**
Mühmer, D., RWTH Aachen University (Aachen, DE)

**10.00 AM** **Carbon-free electrically heatable coarse-grained composite materials consisting of (Nb/Ta)-$Al_2O_3$ and alumina**
Franke, N., TU Bergakademie Freiberg (Freiberg, DE)

**10.20 AM** **Steel Ceramic Composite anodes based on recycled MgO-C lining bricks for applications in cryolite/aluminum melts**
Yaroshevskyi, S., TU Bergakademie Freiberg (Freiberg, DE)

# FRIDAY 29TH SEPTEMBER

## ENGINEERING OF REFRACTORIES

Chairs: Romero Baivier, S., Vesuvius (Ghlin, BE); Gruber, D., Montanuniversität Leoben (Leoben, AT)

MISTRAL

09.00 AM – 10.20 AM

**09.00 AM** **Micro-mechanical modelling of heterogenous materials containing microcracks with discrete element method**
Huger, M., IRCER, University of Limoges (Limoges, FR)

**09.20 AM** **Development of an orthotropic elastic-visco-plastic behaviour law for the thermomechanical modelling of refractory masonries**
Gasser, A., University of Orléans (Orléans, FR)

**09.40 AM** **FE modelling of refractories' material properties based on 3D microstructural analysis**
Pirkelmann, S., Fraunhofer ISC, Zentrum HTL Bayreuth (Bayreuth, DE)

**10.00 AM** **Multiscale modeling of gas-slag-refractory interactions and degradation mechanisms**
Laukkanen, A., VTT Technical Research Centre of Finland Ltd (Espoo, FI)

## DRYING AND HEATING OF MONOLITHIC REFRACTORIES II

Chairs: Krause, O., Koblenz University of Applied Sciences (Höhr-Grenzhausen, DE); Goski, D., Allied Mineral Products, LLC (Columbus, US)

MERIDIAN 1

09.00 AM – 10.40 AM

**09.00 AM** **A further link between laboratory analysis and industrial process optimization – The size effect on drying of refractory castables**
Moreira, M., Federal University of São Carlos (Sao Carlos, BR)

**09.20 AM** **Microwave sintering of ZnO-containing in-situ spinelized alumina-based castables**
Borges, O., Federal University of São Carlos (São Carlos, BR)

**09.40 AM** **Impact of Dryout Heating Rate on Physical Properties**
Sayre, J., HarbisonWalker International (Pittsburgh, US)

**10.00 AM** **Observations on the strength and drying performance of SolCast castables**
Piippo, A., Bet-Ker Oy (Raahe, FI)

**10.20 AM** **Effect of curing temperature and curing time on the properties of low cement bonded corundum – spinel castables for well block**
Zhang, S., Punai Refractories Group Co.,Ltd.(PRCO) (Henan province, CN)

# FRIDAY 29TH SEPTEMBER

## RAW MATERIALS – ALUMINA MATERIALS I

Chairs: Klaus, S., Almatis GmbH (Frankfurt, DE); Bunt, N., IMERYS (Paris, FR)

MERIDIAN 2

09.00 AM – 10.40 AM

**09.00 AM** **Data-based carbon footprint of Imerys specialty minerals for refractories**
Ranaivoharilala, S., IMERYS (Paris, FR)

**09.20 AM** **Sintering and thermo-mechanical characterization of a novel refractory grade bauxite**
Noronha, L., Federal University of São Carlos (São Carlos, BR)

**09.40 AM** **Almatis Mission NeutrAL represents our sustainable commitment to the refractory raw materials industry**
Compson, C., Almatis (Leetsdale, US)

**10.00 AM** **Managing Performance of Calcined Aluminas through Manufacturing Process Modifications**
Zetterström, C., Alteo Alumina (Gardanne, FR)

**10.20 AM** **Influence of mineral composition on the processing of iron-rich bauxite raw materials by using hydrochloric acid leaching**
Sax, A., University of Koblenz (Koblenz, DE)

## PRIMARY METALLURGY II

Chairs: Brüggmann, C., Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG (Siegen, DE); Sengupta, U., Refratechnik Steel India (Vizag, IN)

HORIZONT

09.00 AM – 10.40 AM

**09.00 AM** **Innovative Design and Installation Technique for Slag Door of CONARC Furnace – A unique Approach for Performance Hike-up**
Schemmel, T., Refratechnik Steel GmbH (Düsseldorf, DE)

**09.20 AM** **Novel microporous MgO-based high-temperature thermal insulator**
Salomão, R., University of São Paulo (São Carlos, BR)

**09.40 AM** **Next Generation Electric Arc Furnace Gunning Products for Improved Sustainability**
Gurcan, C., Minteq Asmas (Gebze, Kocaeli, TR)

**10.00 AM** **Refractory solutions to "the Carbon Challenge"**
Li, Y., Wuhan University of Science and Technology (Wuhan, CN)

**10.20 AM** **Prefabricated slag door solution – resolve a well-known obstacle to increase EAF performance**
Buchberger, B., Mayerton Refractories Ltd (Solihull, GB)

# FRIDAY 29TH SEPTEMBER

## SYNTHESIS OF MATERIALS III

Chairs: Moritz, K., Technische Universität Bergakademie Freiberg (Freiberg, DE); Steffen, T., Forschungsgemeinschaft Feuerfest e. V. (Höhr-Grenzhausen, DE)

PLATEAU 2

11.00 AM – 12.20 PM

**11.00 AM** **Engineered Refractory Aggregates Comprising Higher Grade Shell and Lower Grade Core**
Zhang, S., University of Exeter (Exeter, GB)

**11.20 AM** **Preparation and Properties of Whisker Composite Magnesium Aluminate Spinel Refractories by In-situ Catalysis**
Schulze-Bergkamen, H., RHI Magnesita (Dalian, CN)

**11.40 AM** **Compositional Complex Ceramic coatings for corrosion resistance of refractories**
Maier, J., Fraunhofer ISC, Zentrum HTL (Würzburg, DE)

**12.00 PM** **Dispersion of surface modified Nano additives by silanol groups and its effect on properties of Oxide and Oxide-C refractories**
Nourbakhsh, A., Arvin Dirgodaz Vijeh Co (Isfahan, IR)

## INNOVATION IN REFRACTORY APPLICATIONS

Chairs: Dannert, C., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); Braulio, M., 4CAST (Sao Carlos, BR)

MISTRAL

11.00 AM – 12.20 PM

**11.00 AM** **Design optimization of refractory castable panels for alumina calciner linings via finite element simulations**
Ierck Pereira, C., Federal University of São Carlos (Sao Carlos, BR)

**11.20 AM** **Development of Vibrocast Alumina-spinel Inner Nozzles for Vacuum Ingot Casting**
Martynenko, V., Ukrainian Research Institute of Refractories named after A.S. Berezhnoy (Kharkiv, UA)

**11.40 AM** **Development of high-performance silica refractory with low residual quartz for coke oven batteries**
Biswajit, G., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**12.00 AM** **Development of high chrome oxide gasifier refractories – one step ahead towards carbon neutrality**
Nayak, J., TRL Krosaki Refractories Ltd. (Belpahar, IN)

# FRIDAY 29TH SEPTEMBER

## DRYING AND HEATING OF MONOLITHIC REFRACTORIES III

Chairs: Simmat, R., Forschungsgemeinschaft Feuerfest e. V. at the European Centre for Refractories (Höhr-Grenzhausen, DE); Samanta, A., TRL Krosaki Refractories Ltd. Gumadera (Belpahar, IN)

MERIDIAN 1

11.00 AM – 12.20 PM

**11.00 AM** **Impact of curing temperatures and drying under hydrothermal conditions on phase composition and microstructure of cement bonded castables**
Koehler, A., Almatis GmbH (Ludwigshafen, DE)

**11.20 AM** **$CO_2$-footprint reduction in dry tundish wear lining installation with respect to refractory material and electrical equipment (eMould) technology**
Sari, E., Weerulin GmbH (Mülheim an der Ruhr, DE)

**11.40 AM** **Investigation of the Drying Behavior of Low Cement Castables**
Klippel, U., Calderys Deutschland GmbH (Neuwied, DE)

**12.00 PM** **A novel type of anti-spalling natural straw fibers for refractory castables**
Zhang, M., Höganäs Borgestad AB (Bjuv, SE)

## RAW MATERIALS – OTHER MATERIALS

Chairs: Cölle, D., EKW GmbH (Eisenberg, DE); Pandolfelli, V., Federal University of São Carlos (São Carlos, BR)

MERIDIAN 2

11.00 AM – 12.00 PM

**11.00 AM** **Tailor-made Polycarboxylate Ethers to Improve Properties of Castable Mix Designs**
Riedmiller, J., BASF Construction Additives (Trostberg, DE)

**11.20 AM** **Innovative approaches for energy-intensive production processes of shaped refractory products for the steel industry**
Cölle, D., EKW GmbH (Eisenberg, DE)

**11.40 AM** **Digitalization to realize an automatic and continuous refractory maintenance system SCANTROL™ 4.0 for the EAF**
Lamm, R., Minteq International GmbH – Ferrotron Division (Duisburg, DE)

# FRIDAY 29TH SEPTEMBER

## PRIMARY METALLURGY III

Chairs: Brüggmann, C., Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG (Siegen, DE); Sengupta, U., Refratechnik Steel GmbH (Vizag, IN)

HORIZONT

11.00 AM – 12.40 PM

**11.00 AM** **Improve furnace lifetime and operational safety by robotic gunning repair**
Wolf, C., Velco GmbH (Velbert, DE)

**11.20 AM** **Effect of Magnesia Grain Size Composition on Internal Pore Structure in Magnesia Carbon Refractory Bricks**
Furukawa, T., Shinagawa Refractories Co., LTD (Bizen-City, Okayama, JP)

**11.40 AM** **Development of integrated methods for hot repair of converter lining based on Magnesian materials of "Gir-Refractories"**
Goryuk, M., Physical-Technological Institute of Metals and Alloys, National Academy of Sciences of Ukraine (Kyiv, UA)

# POSTERS

**P 01** **The preparation of electrical-grade magnesia from microcrystalline magnesite**
Li, Z., Puyang Refractories Group Co.,Ltd. (Puyang, Henan, CN)

**P 03** **Effect of particle size and calcinated conditions on the properties of highly active magnesium oxide from microcrystalline magnesite**
Wang, X., Punai Refractories Group Co.,Ltd.(PRCO) (Puyang, Henan, CN); LIU, C., Puyang Refractories Group Co., Ltd (PRCO) (Puyang, CN)

**P 07** **A novel approach to develop sustainable cement-free magnesia castables**
Peng, H., Elkem Silicon Products Development (Kristiansand, NO)

**P 10** **Effect of $H_2O_2$ addition an anti-explosion performance of Alumina based castables bonded by hydratable Alumina**
Wang, Z., State Key Laboratory of Advanced Refractories (Luoyang, CN)

**P 11** **Development of low $CO_2$ emission repair material at basic oxygen furnace (BOF) application**
Brum, P., SHINAGAWA REFRACTORIES CO.,LTD (Vinhedo, BR)

**P 12** **$Al_2O_3$-SiC-C castable development with improved oxidation resistance**
Jung, B., KOREA REFRACTORIES (Chungcheongnam-do, KR)

**P 14** **Innovation in Carbon Footprint reduction and sustainability in the manufacturing of Insulation firebricks for lining of blast furnace stove**
Natarajan, C., Carborundum Universal Limited (Ranipet, IN)

**P 15** **Improvement of gas holder system**
Imaeda, T., TYK Corporation (Gifu prefecture, JP)

**P 16** **Development of a Novel Taphole Clay with Toxicity-free and Odor-lighten**
Miyajima, S., Krosaki Harima Corporation (Kitakyushu, JP)

**P 18** **Development of a novel thermal shock protocol of experiment of carbon-based refractory materials**
Anrhour, K., VESUVIUS, Trento University (Mons, BE)

**P 19** **KUMAS's New Generation MgO-C Brick Development**
Sarioglu, N., KUMAS Manyezit Sanayi A.Ş. (Kutahya, TR)

**P 22** **Microstructural evolution and corrosion behavior of rebounded magnesia-chromite refractories used in steelmaking RH furnaces**
Bavand-Vandchali, M., Almas Alborz Refractories Co (Tehran, IR)

**P 25** **Thermophysical properties of $Ca^{2+}Cr^{3+}$-$Fe^{3+}$ doped $LaAlO_3$ high emissivity ceramic**
Wang, Q., Sinosteel luoyang institute of refractories research co., ltd (Luoyang, CN); Wang, G., Sinosteel luoyang institute of refractories research co., ltd (Luoyang, CN)

**P 26** **Mechanical and chemical behavior of MgO-C bricks under near-service conditions**
Galliano, P., Tenaris Siderca (Campana, VE)

**P 27** **Development of olivine based precast castable for tundish weir and dam**
Yeh, S., Good Furnace Refractory Industrial Co.,Ltd. (Taipei, TW)

**P 28** **Carbon bonded rods for measurement of molten steel velocity at the meniscus level in the continuous caster mould: from the lab to the plant trials**
Luchini, B., Tata Steel Nederland (Velsen-Noord, NL)

# POSTERS

# POSTERS

**P 58** **Analysis of corrosion mechanisms of non-cement and low-cement alumina-magnesia gunning mix with special calcined alumina in rotary slag test**
Lee, Y., HSIN LIAN HSIN ENTERPRISE CO., LTD (Kaohsiung, TW)

**P 59** **Ceramic foam filters with a carbon-bonded alumina coating for aluminum melt filtration**
Voigt, C., Technische Universität Bergakademie Freiberg (Freiberg, DE)

**P 60** **Enhanced infrared radiation of $LaAlO_3$ ceramics via $Co^{2+}$ doping**
Pan, L., Puyang Refractories Group Co., Ltd. (Puyang, CN)

**P 61** **Formation of isolation layer between the refractory lining and molten steel/slag: Industrial trials in refining ladle**
Chen, J., Wuhan University of Science and Technology (Wuhan, CN)

**P 62** **Refractory Handling Manipulator for safe & better ergonomics**
Sahin, A., TRL Krosaki Refractories Limited (Jamshedpur, Jharkhand, IN)

**P 63** **Improvement of thermo-mechanical properties of direct bonded magnesia chrome refractories for RH Degasser**
Ghosh, B., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**P 64** **Performance improvement of steel ladle MgO-C refractories by using novel carbon additives**
Ghosh, B., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**P 65** **Effect of firing temperature on thermo-mechanical properties of Low Cement Castables**
Samanta, A., TRL Krosaki Refractories Ltd. Gumadera (Belpahar, IN)

**P 66** **Influence of Pitch Type on Properties of Blast Furnace Trough Castable**
Kanagawa, T., (Bizen-shi, Okayama, JP)

**P 67** **Understanding how the binder system influences the properties and process performance indicators of taphole clays**
Garbers-Craig, A., University of Pretoria (Pretoria, ZA)

**P 68** **Modifications in Ladle Slide Gate System for improving Safety & Productivity**
Ali, S., TRL Krosaki Refractories Ltd. (Belpahar, IN)

**P 69** **Performance of Novel Silica Dry Vibrating Refractory Lining Mixes without pure Boric Acid or Boron Oxide in Crucible Induction Furnaces in the Iron Foundries**
Atanga, V., Dörentrup Feuerfestprodukte GmbH & Co. KG (Dörentrup, DE)

**P 70** **Transmission conditions across a thin Thermoelastic interphase**
Pande, S., Università degli Studi di Trento (Trento, IT)

**P 71** **Alumina/aluminum titanate based model refractory material: a promising microstructural design to enhance thermal shock resistance**
Mouiya, M., Université de Limoges (Limoges, FR)

**P 72** **Microstructure Design of a more Sustainable Alumina-spinel Refractory Castable**
Boateng, K., Imerys S.A. (Vaulx Milieu, FR)

**P 74** **Discrete Element Method (DEM) to support microstructure design of refractories**
Ranganathan, H., Imerys Technology Center (Vaulx Milieu, FR)

# POSTERS

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# SPECIAL EVENTS

## WOMEN@REFRACTORIES

**Wednesday, 27th September**

**Start 6.00 PM – 10.00 PM, room Sirius (1st floor)**

**Glass ceiling or sticky floor? Get your leadership inspiration you did not know you need!**

Connect and exchange with the female force of the refractory industry. Women in research, science and the industry itself are thriving and on the rise. At RHI Magnesita the share of senior leadership positions held by females is 19%.

With the "Women@Refractories" event, RHI Magnesita aims to co-create with each and every one of you a networking and exchange platform for everyone interested.

The informal event will be hosted by four of our talented female leaders with different professional and personal backgrounds. We want to share a stage with you to talk about different career paths, the highlights as well as the challenges, and experiences as a minority in the refractory industry.

The event is open to every participant of the UNITECR 2023, no matter your gender identity!

Join us and our four female hosts on the 27th September 2023 for an inspiring & empowering apéro – drinks, snacks and conversations included.

## YOUNG PROFESSIONALS

**Thursday, 28th September**

**09.00 AM – 05.00 PM, room Komet, REFRAup Lounge (3rd Floor)**

Invitation to the participating students to meet with representatives of the sponsor in the REFRAup Lounge and to discuss the latest developments, e.g. virtual reality.

There you will find info, games, fun, snacks, and an invitation to the Conference Dinner in the Palmengarten at the exclusive REFRAup table.

You will be able to collect a few first impressions of the Refratechnik world, and with a bit of luck and skill you might even win the latest console..

## GUSTAV EIRICH AWARD

**Thursday, 28th September**

**11.00 AM, room Meridian**

The aim of this award is to promote ideas and, at the same time, to support young talents in technical disciplines.The Gustav Eirich Award is a contribution to the long-term success of companies in the refractories production and application industries.

The Gustav Eirich Award is presented for the three best dissertations (Ph.D. theses) or equivalent work in the field of refractories that have been completed no longer than two years ago.

During the session, the three winners will present their work in 20 minute lectures.

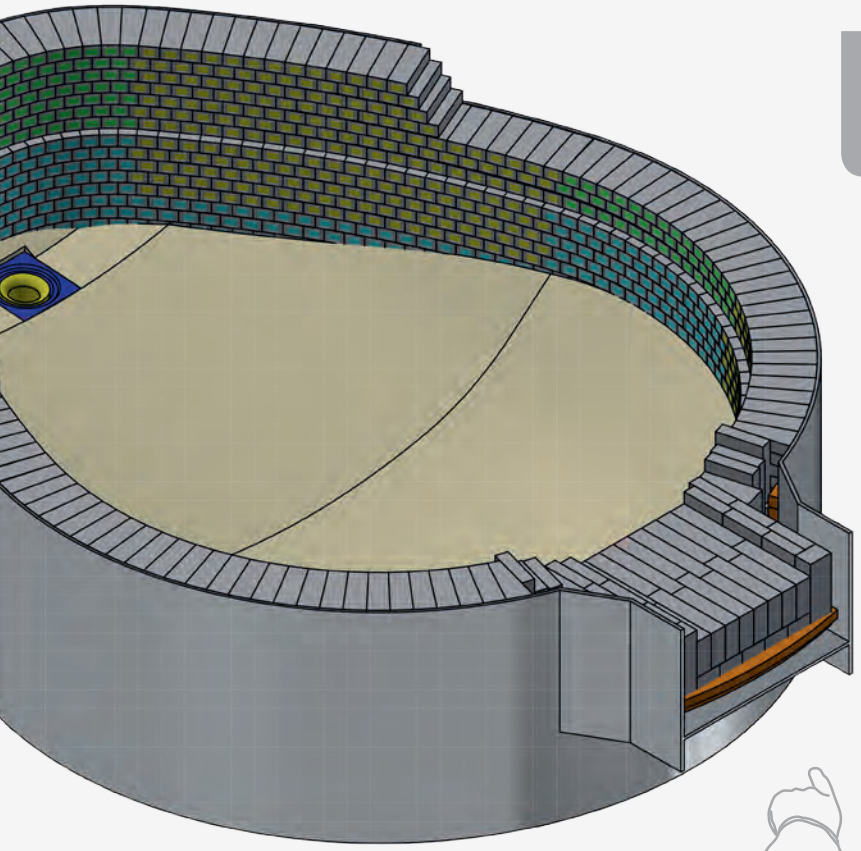
# BEST REFRACTORIES PARTNER TO OUR CUSTOMERS

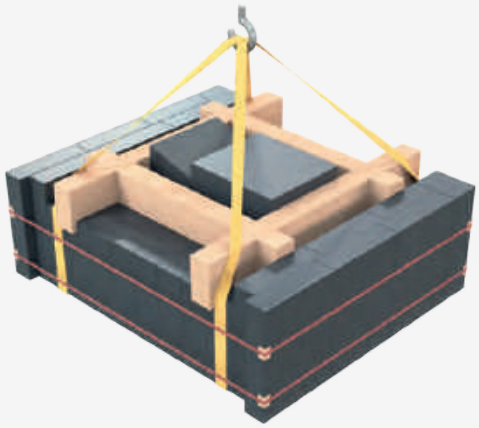
MAYERTON

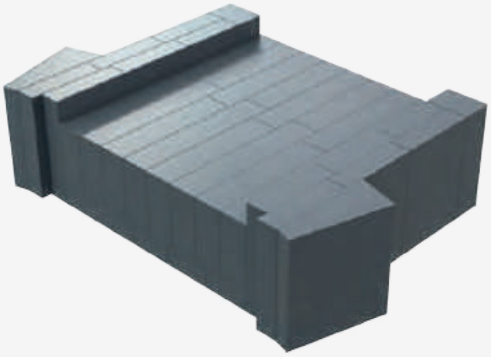
## Prefabricated Slag Door Solution

To Solve a Well Known Obstacle to Increase EAF Performance

**29. September** 10.20 am | **Room** 4 Horizont







mayerton.com

## POSTERS

### POSTER WALK

Submitted posters are mounted on pinboards in the poster exhibition (1st floor, poster area) and can be viewed all day.

### POSTER SLAM

**Wednesday, 27th September**
**04.40 PM**

At the SLAM, registered authors will present the main technical features of their work in one minute and invite visitors to visit their own poster in the poster area.

### POSTER AWARD CEREMONY

**Wednesday, 27th September**
**06.00 PM**

The jury will evaluate the 3 best presentations in terms of their successful short presentation. After a round of evaluation, the AWARD ceremony will take place at 6.00 PM.

The poster WALK will start directly after the AWARD ceremony. Refreshments and pretzel snacks will be served during the tour of the poster exhibition..

Moderation: Prof. Dr. Christos G. Aneziris and Dr. Christian Dannert

Jury: Chris Parr (Imerys, Chair), Jens Sperber (STEULER), Karin Scharrer (refractories WORLDFORUM)



# SPECIAL THANKS TO

## SPONSOR OF THE DAY

Food & Beverage on Wednesday. Each participant should drink 2-3 liters daily. Food connects. Important things are discussed over a meal. About business, sports or politics, the family or the respective hobbies.

## CONFERENCE BAGS

Each conference attendee will receive a conference bag containing various informational material about the conference. The bag will be handed out in the main entrance foyer.

## LANYARDS

Each conference participant has received a lanyard to attach their name badge to.

All participants are urgently asked to wear this lanyard with the name badge, as it gives proof of a valid day ticket at the dispensing stations for drinks and lunch. The Conference Ticket also applies to access to the conference dinner in the Palmengarten.

## WRITING PADS AND PENS

Each participant has received his/her conference bag a writing pad as well as a pen.

# The European Center of Refractories

**future – systemrelevant – sustainable – unique**

## Knowledge – Education – Training

European Centre for Refractories ECREF

The Integrated Refractory Education System (IRES) supports the development of young school leavers across all levels of vocational education and training, from basic apprenticeship courses through to graduate and doctorate programmes. The Koblenz University of Applied Sciences offers a complementary vocational programme that leads to the qualification of Ceramic Technician ("Keramiktechniker") as well as an academic programme leading to the degree of Bachelor of Engineering which, in cooperation with the University of Koblenz and Landau, can be crowned with the degree of Master of Ceramic Science and Engineering. This cluster of expertise in conjunction with the close collaborative relationship maintained with the University and the Ceramics Education and Research Centre (Bildungs- und Forschungszentrums Keramik e.V. / BFZK) enables the wealth of knowledge about refractory products, their manufacture and use to be imparted and shared in a well-condensed way across all levels, up to the university-awarded doctoral degree.

## Bildungs- und Forschungszentrum Keramik (BFZK)

BFZK

BFZK offers with its 8 institutes in Höhr-Grenzhausen a combination of facilities that is unique in the world, all of which deal with the topic of training and further education as well as research within ceramics. The Montabaur vocational school, with its ceramics branch, is one of the dual partners in ceramics initial training and teaches the necessary theoretical knowledge for successful completion as a skilled worker in industry or as a journeyman in the trade. Further training as a ceramics technician or ceramics designer at the technical colleges for ceramics technology and ceramics design is then just as possible as studying for a bachelor's or master's degree in engineering – materials engineering, ceramics and glass – on the Westerwald Campus. Furthermore, with the Bachelor or Master of Fine Arts at the Institute for Artistic Ceramics and Glass, which also belongs to the Koblenz University of Applied Sciences, there are opportunities for further training in areas of art. Information about the 8 members of the education and research center: www.bfzk.de

# The European Center of Refractories

## Study Guide "Materials Engineering Glass & Ceramics"

HOCHSCHULE KOBLENZ
UNIVERSITY OF APPLIED SCIENCES

The Koblenz University of Applied Sciences offers an application-oriented, engineering Bachelor of Engineering, Bachelor of Engineering dual, Ceramics Industrial Engineer and a consecutive Master of Ceramic Science and Engineering on the Westerwald campus. The range of courses: broadly based, clearly focused on ceramics and glass, unique. The location can look back on a 150-year tradition in training and is the oldest location of the Koblenz University of Applied Sciences. Together with the local research institutions, the European Center for Refractories (ECREF) and the Research Institute for Inorganic Materials-Glass-Ceramics (FGK), the location forms a unique concentration of training and research in a small radius. All those involved benefit from research and teaching, which also directly benefit training through joint projects with industry-related research. Due to the close and exceptionally good networking with the refractory or ceramic industry, contacts are made at an early stage, which enables the students to write their theses in the companies where they later find their professional start. Both bachelor's and master's students have excellent opportunities on the job market.

Prof. Dr. Amin El Gammal

## Master's degree „Refractory Engineering" Tandem professorship at Koblenz University of Applied Sciences

NEW

The German refractory industry is a world leader in product quality and in the application areas of high-temperature processes for steel, cement or glass. The processing of refractory materials is of particular importance. That is why the German refractory industry is supporting the establishment of a professorship „Refractory Engineering" at the Koblenz University of Applied Sciences.as an industrial partner. On the professorship Dr. Amin El Gammal appointed. This tandem professorship between the Koblenz University and the refractory industry will be connected in the European Refractory Center and the Westerwald-Campus and organized by ECREF gGmbH. The development of the part-time English-language master's degree program „Refractory Engineering" is aimed in particular at international bachelor's graduates in materials science or civil engineering who are about to or after starting their business careers. The content will be divided into the three areas of „ Refractory Engineering", „Refractory Materials" and „Services". Aspects such as building law, construction site management or approval procedures are also dealt with in the curriculum.


Managing Directors: **Dr. Christian Dannert | Thomas Kaczmarek**

Rheinstr. 58
56203 Höhr-Grenzhausen
Germany

+49 2624 94 33 130

info@ecref.eu

www.ecref.eu

# SIGHTSEEING

## VISIT TO EBERBACH MONASTERY

**Wednesday, 27th September**
**10.30 AM – 03.00 PM**
**Start and finish: Kap Europa**

The shuttle bus from Kap Europa will take you directly to the former Cistercian Monastery of Eberbach near Eltville next to the river Rhine, which is famous for its vinyards.

The monastic complex with its Romanesque and early Gothic buildings is one of the most important art monuments in Europe. With 900 years of monastic history, there is a lot to tell. During a guided tour through the buildings and outside areas you will learn, exciting and entertaining facts about the life of the monks, the changing history of the monastery and its current use.

Afterwards, a rustic lunch is set for you in the cloister tavern. Of course, you can also taste the unique quality wines from the monastery-owned vineyards, before going back to Frankfurt around 02.30 p.m.



## CITY TOUR FRANKFURT MAIN / GUIDED BUS TOUR

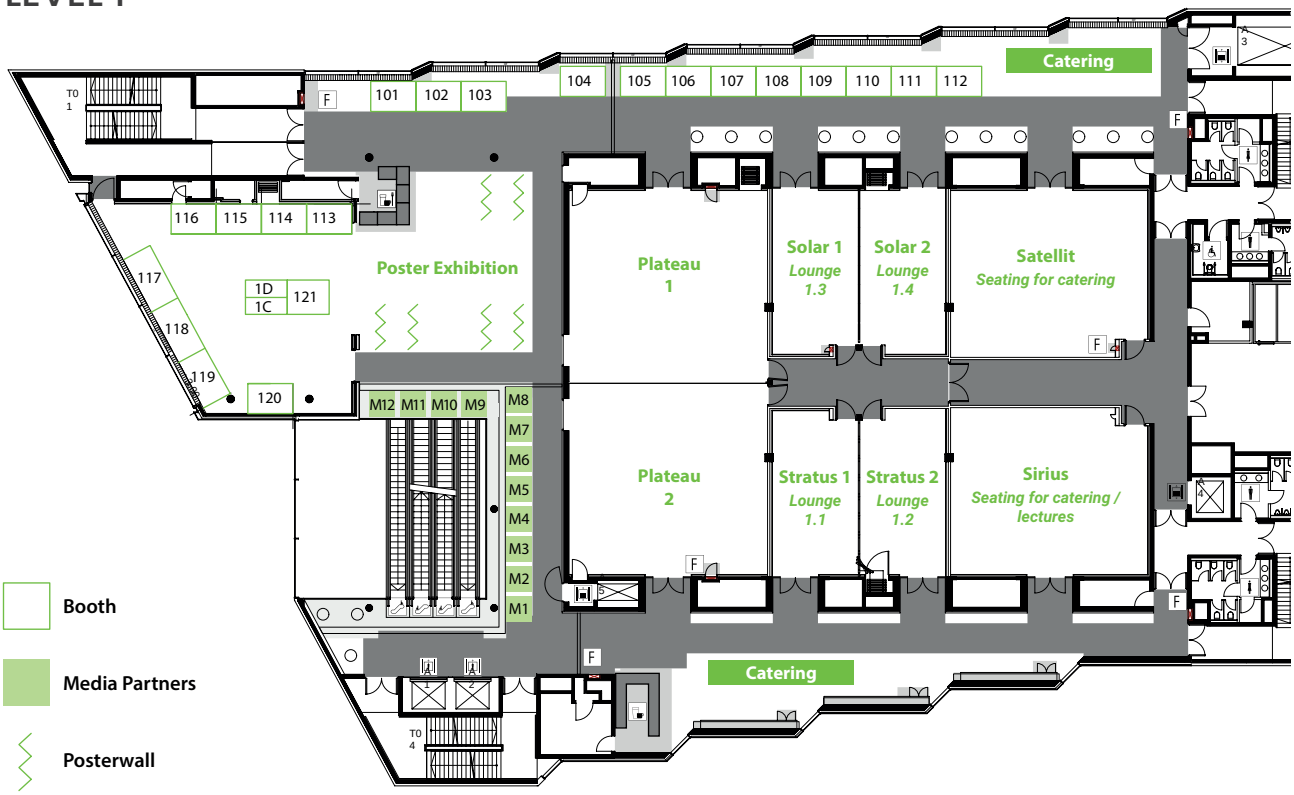
**Thursday, 28th September**
**10.00 AM – 11.30 AM**
**Start and finish: Kap Europa**

Tour through Frankfurt on the city's development from the medieval period to the present day and on the connection between old and modern Frankfurt, with exciting details about interesting buildings and future projects.

» **PLEASE CHECK WITH THE ONSITE REGISTRATION COUNTER AT KAP EUROPA FOR AVAILABILITY.**

# INDUSTRY EXHIBITION

## LEVEL 1

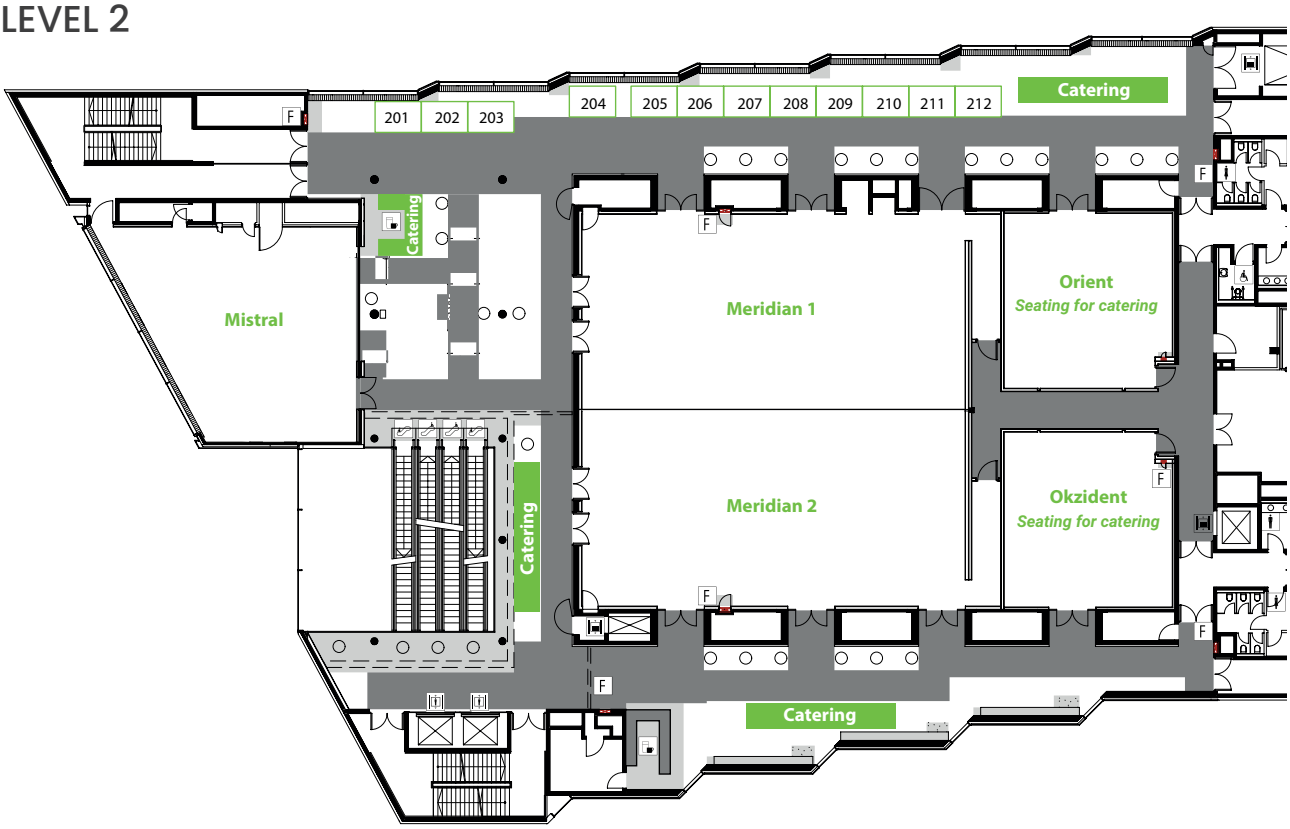



# MEDIA PARTNERS

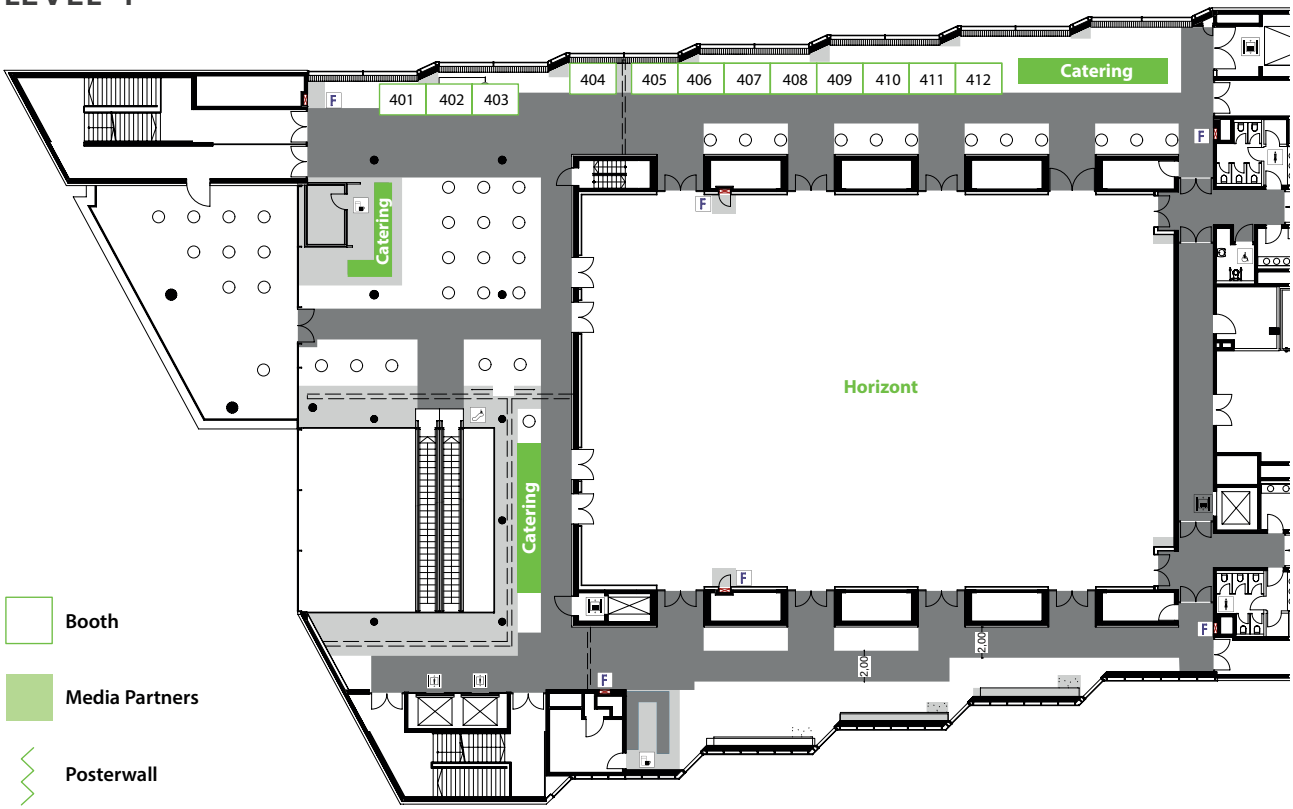
| BOOTH | MEDIA PARTNER | CONTACT | E-MAIL |
|---|---|---|---|
| M1 | American Ceramic Society bulletin | Pam Wilson | pwillson@ceramics.org |
| M2 | stahl+technik DVS-Verlag | Katrin Küchler and Claudia Wolf | katrin.kuechler@dvs-media.info |
| M3 | China's Refractories | Wang Jing | chnr@nhcl.com.cn |
| M4 | Institute of Ref. Enginneers | Andrew Turner | advertising@ireng.org |
| M5 | Refractory Window | Cathy Zhang | cathy@refwin.com |
| M6 | stahl. Vulkan Verlag | Sarah Gottschallk | redaktion.stahl@vulkan-verlag.de |
| M7 | STEEL + Metalurgy | Pradipta Sengupta | pradipta@steelmetallurgy.com |
| M8 | marketSTEEL | Dagmar Dieterle | dieterle@marketsteel.de |
| M9 | IMFORMED | Mike O´Driscoll<br>Ismene Clarke | ismene@imformed.com -<br>mike@imformed.com |
| M10 | Refractories Worldforum<br>Göller Verlag | Karin Scharrer and Corinna Zepter | k.scharrer@goeller-verlag.de |
| M11 | ZKG Bauverlag | Anke Bracht | anke.bracht@bauverlag.de |
| M12 | Iron & Steel Review | Santosh Mahanti | contact@isrinfomedia.in |

# INDUSTRY EXHIBITION

## LEVEL 2




## LEVEL 4



# INDUSTRY EXHIBITION

| BOOTH NUMBER | COMPANY NAME AND ADDRESS | SHORT PROFILE |
|---|---|---|
| 101 | Washington Mills<br>64 Mosley Road, Trafford park<br>Manchester M32 8JD<br>United Kingdom | Washington Mills is a family-owned company, committed to the long-term success of the enterprise. We offer solutions to fused mineral, abrasive grain and powder requirements. |
| 102/103 | Almatis GmbH<br>Lyoner Straße 9<br>60528 Frankfurt/Main<br>Germany | Almatis has the broadest alumina portfolio to the refractory industry and is committed to develop products with lower carbon footprint and sustainable advantage. |
| 104 | Thyme Europe Limited<br>1 Northumberland Avenue Trafalgar Square<br>London WC2N 5BW<br>United Kingdom | Versatile supplier of industrial minerals for refractory, abrasive, aluminium, ceramics. Comprehensive sourcing, quality inspection, logistics, and financing solutions |
| 105 | Chemische Fabrik Budenheim KG<br>Rheinstraße 27<br>55257 Budenheim<br>Germany | |
| 106 | ShengChuan Advanced Material Technology Co. Ltd, NieCun,LuoCun Town<br>ZiChuan District, ZiBo City<br>ShanDong Province<br>China | ShengChuan AMT is top CAC manufacturer in China. VICAL ® is refractory brand, customers' reliable choice for the stable performance & technical services. |
| 107/108 | PENNEKAMP MIDDLE EAST<br>Office 30C-09<br>I-Rise Tower<br>TECOM, DUBAI, UAE | Supplying Refractories raw materials and Refractories finished products. |
| 109/110 | Fiven GmbH<br>Gertrudenstraße 30-36<br>50667 Köln<br>Germany | Fiven is the global leader in the production of Silicon Carbide (SiC). We produce grains & powders for the refractory, metallurgical, abrasive and technical ceramics industry. |
| 111 | ESK-SIC GmbH<br>Günter-Wiebke-Strasse 1<br>50226 Frechen<br>Germany | |
| 112 | Rain Carbon Germany GmbH<br>Kekuléstr. 30<br>44579 Castrop-Rauxel<br>Germany | Rain Carbon offers the complete range of carbon binders to produce shaped and monolithic refractories: CARBORES®; PETRORES®, Impregnation Pitch |
| 113 | ALAFAR<br>Asociación Latinoamericana de Fabricante de Refractarios<br>Contagem, Minas Gerais<br>Brasil | |
| 114 | 4D Delta<br>1/216 Fulham St,<br>Cloverdale WA 6105<br>Australia | |

# INDUSTRY EXHIBITION



| CONTACT | WEBSITE |
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| Devang Chowdhary<br>devang@thymeeuro.com | www.thymeeuro.com |
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| +86-13070660465<br>1474221457@qq.com | |
| Masoud Jamaati<br>+971555582651<br>masoud@pennekamp-me.ae | www.pennekamp-me.ae |
| | www.fiven.com |
| | |
| Christoph Jacob<br>+49 1624246862<br>christoph.jacob@raincarbon.com | www.raincarbon.com |
| sirefmg@fiemg.com.br<br>+ (55 31) 3368-1123 | www.alafar.org |
| Don Merritt<br>don.merritt@4ddelta.com | www.4ddelta.com |

# INDUSTRY EXHIBITION

| BOOTH NUMBER | COMPANY NAME AND ADDRESS | SHORT PROFILE |
|---|---|---|
| 115 | HÄNDLE GmbH Maschinen- und Anlagenbau<br>Industriestr. 47<br>75417 Mühlacker<br>Germany | For more than 150 years, HÄNDLE is one of the leading manufacturers of machinery and equipment for a wide range of building materials industries in over 100 countries worldwide. |
| 116 | IMCE NV<br>Slingerweg 52<br>Poort Genk 5489<br>3600 Genk<br>Belgium | RFDA measurement equipment for NDT material characterization, accurately determining elastic properties at room and elevated temperatures up to 1700°C. |
| 117 | Refmin | |
| 118/119 | Alteo | |
| 120 | Nissin Kikai Co., Ltd.<br>744-1 Ichinomiya-cho<br>Takamatsu-City<br>Kagawa-Prefecture<br>Japan | We develop and sell high-temperature material property evaluation and visualization equipment. |
| 121 | • German Refractory Association (DFFI)<br>• Deutsches Institut für Feuerfest und Keramik (DIFK)<br>• European Centre for Refractories (ECREF)<br>• Forschungsgemeinschaft Feuerfest e. V. (FGF) | |
| 122 | Koblenz University of Applied Sciences<br>Rheinstr. 56<br>56203 Höhr-Grenzhausen<br>Germany | |
| 123 | TU Bergakademie Freiberg<br>Institut für Keramik, Feuerfest und Verbundwerkstoffe<br>Agricolastraße 17<br>09599 Freiberg<br>Germany | |
| Lounge 1.1 | **Almatis GmbH** | |
| Lounge 1.2 | **Cofermin Rohstoffe GmbH + Co KG** | (Wednesday, 27th September and Thursday, 28th September only) |
| Lounge 1.3 | **Imerys** | |
| Lounge 1.4 | **Zhejiang Zili Advanced Materials Co., Ltd**<br>**IMEXCO Minerals GmbH** | (Wednesday, 27th September only)<br>(Thursday, 28th September only) |

# INDUSTRY EXHIBITION



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| Christina Eid<br>+49 7041 891-271<br>c.eid@haendle.com | www.haendle.com |
| Bart Bollen<br>+32 89 41 00 70<br>Bart.bollen@imce.net | www.imce.net |
| | |
| | |
| sales@nissin-kikai.co.jp | www.nissin-kikai.co.jp |
| +49 2624 94 33-140<br>office@ecref.eu | www.dffi.de<br>www.difk.de<br><br>www.ecref.eu<br>www.fg-feuerfest.de |
| Tina Klersy<br>+49 2624 9109-16<br>klersy@hs-koblenz.de | www.hs-koblenz.de |
| Dr.-Ing. habil. Patrick Gehre<br>+49 3731 39-2709<br>patrick.gehre@ikfvw.tu-freiberg.de | www.ikfvw.tu-freiberg.de |
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# INDUSTRY EXHIBITION

| BOOTH NUMBER | COMPANY NAME AND ADDRESS | SHORT PROFILE |
|---|---|---|
| | **Level 2** | |
| 201 | Shandong Higiant High-purity Alumina Technology Co. Ltd.<br>Guozhuang Industry Zone<br>Linchi Town, Zouping County<br>Binzhou, China | We have been focusing on high purity alumina based raw material with stable quality for refractory industry since its foundation in 2007. |
| 202/203 | IMERYS<br>43 Quai de Grenelle<br>75015 Paris<br>France | As the world's leading supplier of mineral-based specialty solutions, Imerys delivers its high-quality & reliable products to the global refractory industry. |
| 204 | Maschinenfabrik Gustav Eirich GmbH & Co KG<br>Walldürner Straße 50<br>74736 Hardheim<br>Germany | Eirich is a family-managed group of companies operating in the field of special mechanical engineering for mixing, granulating, dispersing & kneading. |
| 205 - 207 | LAEIS GmbH<br>Am Scheerleck 7<br>6868 Wecker<br>Luxembourg | LAEIS is a world leading supplier of high performance hydraulic presses for the production of refractories, technical ceramics and various other applications |
| 208 | Schleibinger Geräte Teubert u. Greim GmbH<br>Gewerbestr. 4<br>84428 Buchbach<br>Germany | We develop and manufacture testing systems for building materials in the field of workability and rheology, shrinkage and expansion, freeze-thaw resistance and ASR-reaction. |
| 209 | Henneke Formbau GmbH<br>Am Mühlengraben 4<br>58849 Herscheid<br>Germany | Mold making for the refractory industry for any Precast elements and bricks, f.ex. Burner, nozzle bricks or Gutter components. Formwork and cores made of polystyrene or wood etc. |
| 210 | Nouryon AB<br>Gamlestadsvägen 18 B-C<br>SE-415 02 Göteborg<br>Sweden | Nouryon is a global, specialty chemicals leader. Our Levasil® colloidal silica works as an excellent binder for both alumina and magnesia refractories |
| 211 | ARCIRESA.- ARCILLAS REFRACTARIAS S.A<br>Castiello sn 33690 Lugo de Llanera<br>Spain | Calcination of Refractory Minerals, milling facilities . Refractory Bauxite, Bauxstar 90 & FBA (substitute of BFA). Wide range of refractory raw materials . |
| 212 | Refra System | |

# INDUSTRY EXHIBITION



| CONTACT | WEBSITE |
|---|---|
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| Wang Yongting<br>+86-13718031281<br>13818031281@163.com | www.higiant-ref.com |
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| Ralf Löbe<br>+49 (0)6283 51 304<br>ralf.loebe@eirich.de | www.eirich.com |
| Peter Bottler<br>+49 160 5021587<br>peter.bottler@laeis.eu | www.laeis.eu |
| | www.schleibinger.com |
| Frank Henneke<br>+49 2391 602470<br>service@henneke.com | www.henneke.com |
| Andreas Sundblom<br>+46 709 577903<br>andreas.sundblom@nouryon.com | www.nouryon.com/levasil |
| Diego Fernandez<br>+34985244584<br>d.fernandez@arciresa.es | www.arciresa.es |
| | |

# INDUSTRY EXHIBITION

| BOOTH NUMBER | COMPANY NAME AND ADDRESS | SHORT PROFILE |
|---|---|---|
| | **Level 3** | |
| Lounge 3.1 | **Bosai Europe GmbH** | |
| Lounge 3.2 | REFRAup Lounge<br>**Refratechnik Holding GmbH**<br>**Hindalco Industries Limited** | <br>(Thursday, 28th September only)<br>(Wednesday, 27th September and Friday, 29th September only) |
| Lounge 3.3 | **ELKEM GmbH** | |
| | **Level 4** | |
| 401 | Bosai Europe GmbH<br>Breite Str. 47-49<br>23552 Lübeck<br>Germany | Supply the world – together. Bosai Europe is your producer and partner for Bauxite and Alumina raw materials. |
| 402/403 | Steuler Refractory Linings<br>Berggarten 1<br>56427 Siershahn<br>Germany | Steuler Refractory Linings is one of the international innovation and market leaders in the field of refractory systems. |
| 404 | CREMER ERZKONTOR GmbH & Co. KG<br>Beckergrube 38-52<br>23552 Lübeck<br>Germany | Founded in 1915, CREMER ERZKONTOR coordinates the international trade, processing, recycling and logistics of raw materials and chemicals with offices on five continents. |
| 405/406 | Purmetall GmbH & Co. KG<br>Niebuhrstr. 57<br>46049 Oberhausen<br>Germany | PURMETALL develops, manufactures and distributes refractories, ladle well fillers, synthetic slags and covering powders for the global steel industry since more than 65 years |
| 407 | Elkem<br>Drammensveien 169<br>0277 Oslo<br>Norway | Elkem is one of the world's leading providers of advanced silicon-based materials shaping a better and more sustainable future. |
| 408 | VELCO GmbH<br>Haberstr. 40<br>42551 Velbert<br>Germany | Velco product range covers gunning machines for refractory dry gunning and gunning robots for the hot repair of EAF, ladles and RH-snorkels |
| 409/410 | New He Qiao Shareholdings Company<br>Minh Tan Ward<br>Kinh Mon City<br>Hai Duong Province<br>Vietnam | We are New He Qiao, the first silicon carbide producer in Vietnam, and a major supplier in the global SiC market. |
| 411/412 | Nabaltec AG<br>Alustr. 50-52<br>92421 Schwandorf<br>Germany | Nabaltec AG manufactures, develops and distributes highly specialized products based on aluminium oxide and aluminium hydroxide |

# INDUSTRY EXHIBITION

| CONTACT | WEBSITE |
|---|---|
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| Daiane Nillpopp<br>+49 2623 600216<br>Daiane.Nillpopp@steuler-kch.de | www.steuler-linings.com |
| Annika Schräger<br>+49 451 929 62 166<br>a.schraeger@erzkontor.com | www.erzkontor.com |
| Vlada Haedrich<br>+49 2088500270<br>haedrich@purmetall.de | www.purmetall.de |
| www.elkem.com/contact/ | www.elkem.com |
| Christian Wolf<br>+49 2051 20870<br>cwolf@velco.de | www.velco.de |
| Zou Yun<br>+86-18588850286<br>zouyun@new-hq.com | www.nhqsic.com |
| Thomas Berens<br>+49 9431 53-910<br>sales@nabaltec.de | www.nabaltec.com |

Deutsche Feuerfest Industrie e.V. DFFI

# Refractory Organisations in Höhr-Grenzhausen

## The Business Association

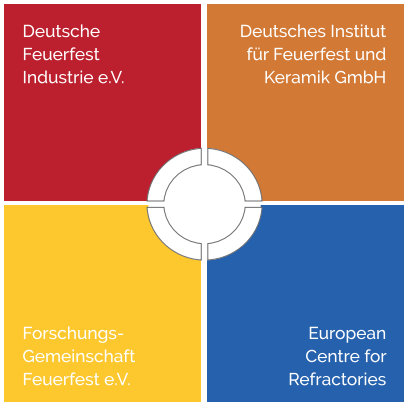
The German Refractory Association (Deutsche Feuerfest-Industrie e.V. | DFFI), founded in 1949, represents and advances the interests of German manufacturers operating in the industry.

The Association collaborates in networks to promote the economic and technological evolution of its member companies by putting forward the jointly adopted positions in both political and societal contexts.

The Association gives a strong voice to the refractory industry – a sector largely dominated by small and medium-sized enterprises.

- Advocacy | Network | Perception
- Environment | Climate | Energy
- Raw Material | Recycling
- Knowlede | Education | Career

**Refractory Organisations in Höhr-Grenzhausen**




Deutsche Feuerfest Industrie e.V. DFFI

Refractory Organisations in Höhr-Grenzhausen

## Service and Performance

The German Refractories Association represents and pursues the politico-economic interests of its member companies vis-à-vis public authorities and government bodies in both national and European contexts.
The Association covers a broad spectrum of issues and activities: It provides comprehensive support and guidance in all matters pertaining to raw materials supply security, environment and energy policy as well as tax, law, research and technology, including questions relating to standardisation.
Major German companies and international brand leaders have joined the Association, which for its part is a member of the national and European network of associations.

DFFI-Board

## The Benefit

- Information about current technical and economic policy developments with special attention to the interests of the refractory industry.
- Creation of legally secure statistics on the development, sales and consumption of refractory products, personnel costs, fuel and energy consumption, development of raw material prices and market developments in the customer industries
- Refractory committee work on technical and environmental issues and participation in BBS, BDI or DIN and ISO.
- European Cooperation (PRE and Cerame-Unie) is bundled and in dialogue with the European Institutions. World trade and regulatory issues are discussed in the World Refractories Association (WRA).

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European Centre for Refractories ECREF

## Refractory Organisations in Höhr-Grenzhausen

## European Centre for Refractories gGmbH

- Operation of a European competence centre for refractory materials and technologies
- Promotion of education and further training in the field of refractories
- Organization and realization of scientific seminars, colloquia and similar events
- Talent programmes with the awarding of grants and awards for scientific work in the field of refractory products
- Steering of standardization activities

**International Colloquium on Refractories**
Congress, Trade Fair and Social Event

**Seminar**
Refractories – Key Technology and its Applications

**Refractory Innovation Days**
Research and Development, Funding Programmes

**Awareness and Relevance**
Websites and Social Media

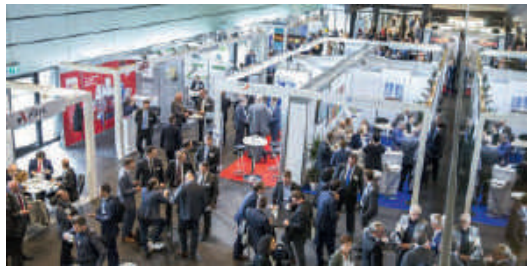
European Centre for Refractories ECREF

## European Centre for Refractories gGmbH

ICR® International Colloquium on Refractories
SCIENTIFIC CONFERENCE AND TRADE FAIR

The International Colloquium on Refractories ICR® is a world-renowned event held annually in the city of Aachen. The event consists of a scientific conference, a trade fair for refractory companies and suppliers of raw materials, machinery, services and knowledge to the refractory industry, and of a varied supporting programm and social event.

Two days of scientific presentations and posters covering all aspects of the latest refractory research (raw materials, processing, refractory materials, applications and recycling)



Trade fair for refractory companies, customer and for suppliers of raw materials, machinery, services and knowledge to the refractory industry.

- **Knowledge Transfer**
- **Scholarships**
- **Education and Training**
- **European Networking**

Managing Directors: **Dr. Christian Dannert | Thomas Kaczmarek**

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Deutsches Institut für Feuerfest und Keramik GmbH

DIFK

## Deutsches Institut für Feuerfest und Keramik GmbH

## Deutsches Institut für Feuerfest und Keramik GmbH

**DIFK Deutsches Institut für Feuerfest und Keramik GmbH** is an independent and international operating test laboratory for testing of refractory raw materials, refractory products like bricks, castables, insulating materials and functional parts and in the case of damage the testing of refractory systems.

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-17672-01-00

- Standardized Testing
- Technical Advice
- Customer Solutions
- International Services

Deutsches Institut für Feuerfest und Keramik GmbH

DIFK

## Deutsches Institut für Feuerfest und Keramik GmbH

The laboratory is accredited by DAkkS under registration number **D-PL-17672-01-00** after **DIN EN ISO / IEC / 17025:2005** and is able to carry out more than 100 standardized resp. specific test methods. In the process chemical, physical and mineralogical methods as well as selected high temperature measuring procedures are used according to the standards and rules of **DIN, EN, ISO, ASTM API, JIS ABNT, CIR,** etc.

Focussed on maximum customer orientation promptness and reliability are the main attributes of the manner of functioning of DIFK Gmbh since more than 25 years. The experienced and consequently trained staff works together with best possible equipment of a modern laboratory. The consulting of the international customers for productive selection of the most suitable measuring methods is the focus of dialog to retain customer satisfaction.

Head of Laboratory: **Dr.-Ing. Thomas Deinet**

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Forschungs-
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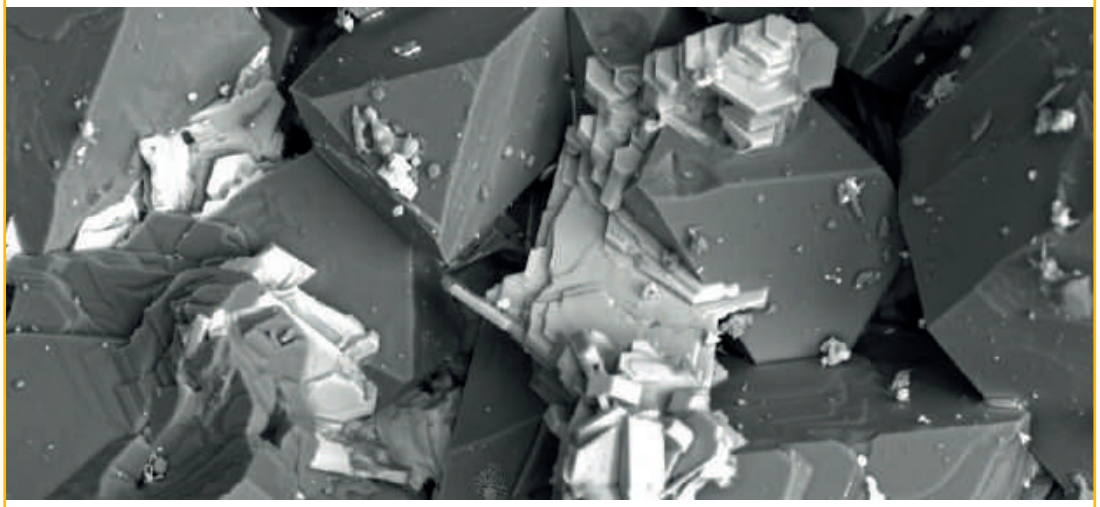
FGF

# Refractory Organisations in Höhr-Grenzhausen



## Forschungsgemeinschaft Feuerfest e. V.

### Research and Innovation

### Technology Transfer

- Patent database and research service
- Training, Publications, Marketing
- Partnerships with the Process Industry

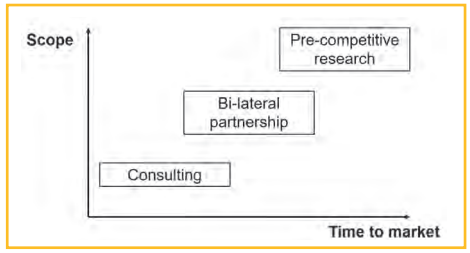
### Project Management

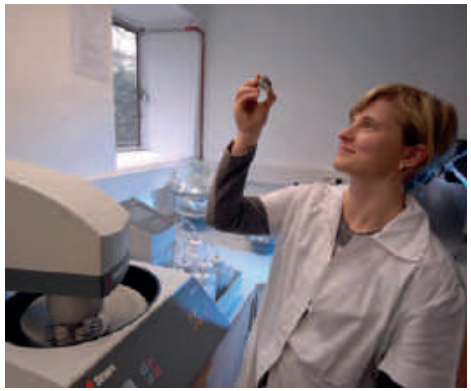
- One stop shop – no hassle with funding agencies

### Funding Advisory Service

- National and European R&D funding – for companies of all sizes

Pathways to Innovation



Forschungs-
Gemeinschaft
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# Forschungsgemeinschaft Feuerfest e. V.

### Research and Innovation

**Methods:**

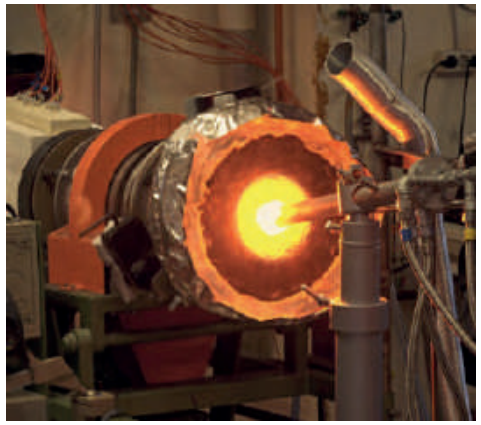
- Development of in situ testing methods for High Temperature Properties
- High temperature thermal shock behaviour
- High temperature gas/liquid corrosion (H2, H2O-vapour, slags, metals)
- High temperature elasticity and dynamic creep
- FEM simulations

**Materials:**

- Refractories, binder systems, secondary raw materials

**Processes:**

- Optimisation of shaping and firing processes



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