

Proceeding of
THE FOURTEENTH INTERNATIONAL
FERROALLOYS CONGRESS

Ukraine, Kiev, May 31-June 4, 2015

INFACON XIV

**Energy efficiency and environmental
friendliness are the future of the global
Ferroalloy industry**

Volume I

Energy efficiency and environmental friendliness are the future of the global Ferroalloy industry:
Proceedings of the Fourteenth International Ferroalloys Congress INFACON XIV.
(May 31-June 4, 2015, Kiev, Ukraine). - К: ООО НПП «Интерсервис», 2015. – 388с.

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FOREWORD

To participants and guests of the INFACON-14 International Ferroalloys Congress

Dear participants and guests of the Congress!

On behalf of the National Academy of Sciences of Ukraine Presidium and on my own behalf I am sincerely glad to welcome all participants and guests of the INFACON-14 International Ferroalloys Congress in the capital of Ukraine, Kyiv city!

Ferroalloy industry is a field without the products of which one can hardly imagine smelting of various steel grades and alloys in ferrous and nonferrous metal industries. It is no accident that ferroalloys are also called “vitamins for steel” which use changes radically all service specifications of alloy metal and the dynamics of ferroalloy industry development conforms fully to world steel production volume growth indexes.

Over forty years of their history, INFACON international ferroalloys congresses became the most reputable forums for experts of ferroalloy and allied industries. Participation in these Congresses will allow getting the right assessment of technical and technological levels, guiding theoretical researches and projects in a right direction, defining perspective directions of development and work performance on technical upgrading of ferroalloy production, including design of new equipment, electric furnace building, production waste processing, energy efficiency, solutions to environmental problems etc.

As an integral part of mining and metallurgy sector of the country, Ukrainian ferroalloy industry makes good headway contributing significantly to Ukrainian economy, cooperating with the National Academy of Sciences and universities as well as with international ferroalloy community.

I am sure that INFACON-14 International Ferroalloys Congress will be an important milestone in the way of development of global ferroalloy science and technology of the entire ferroalloy industry. I wish you successful and fruitful work during plenary meetings and workshops within the framework of this event, tech tours as well as take advantage of the possibility to get acquainted with our country, its ancient capital Kyiv city and appreciate the hospitality of our people occupied with peaceful constructive labour.

**The Honorary Chairman
of the INFACON-14 Congress,
The President of the National Academy of
Sciences of Ukraine**



Boris PATON

To guests and participants of the International Ferroalloys Congress INFACON-14

On behalf of the Extended Programme Committee and Organizing Committee on holding INFACON-14 International Ferroalloys Congress, Ukrainian Association of Ferroalloys and other Electrometallurgical Products Manufactures (UkrFA) we are glad to welcome all delegates and guests of our Congress!

Over its forty year history INFACON congresses became the most significant forums for scientists and experts in the field of ferroalloy production with the traditional exchange of information and opinions on relevant issues of ferroalloy industry development, production of new ideas and directions, presentation and discussion of new achievements in the field of design of efficient ferroalloy equipment and construction of new enterprises. And finally, it is a meeting place for associates and like-minded friends.

The slogan of our fourteenth Congress is ‘Energy efficiency and environmental friendliness are the future of the global Ferroalloy industry’, and we hope that this will be the key approach in the Congress subject area to be discussed within plenary meetings and workshops in the days to come. The same topic will be raised during such events as traditional Technical exhibition and tech tours to leading ferroalloy plants of Ukraine.

The present book contains 102 reports which will be heard during 2 plenary sessions and 24 break-out sessions of 14 sections of the Congress. All reports have been peer-reviewed, for this purpose the large team of international experts has been involved. Program and Organizing committees express sincere thanks to all authors and reviewers for their work.

We also express our appreciation to Chairman of the International Committee on Ferroalloys Nic Barcza and to the Committee Secretary General Rodney Jones for their help in organizing and holding of Congress INFACON-14. We wish to give special thanks to Chairman of the Congress INFACON-13 Manat Tolymbekov whose experience and advices have proved very useful for our work.

INFACON-14 takes place in the capital of Ukraine - the ancient city of Kyiv and as organizers of the Congress we will do our best to provide all our participants and guests with an opportunity to admire amenities and ancient monuments of our capital, get acquainted with Ukrainian customs and traditions, estimate Ukrainian cuisine at its true worth and feel cordiality and hospitality of the Ukrainians.

We wish delegates and guests of the INFACON-14 successful and fruitful work during the Congress in Kyiv. We wish you every happiness, good health and prosperity for years to come!

**Chairman of the
Extended
Programme
Committee and
Programme
Committee**



**prof. Sergey
Grishchenko**

**Chairman of
Organizing
Committee,
Director General of
PJSC “Zaporozhye
Ferroalloy Plant”**



**Pavel
Kravchenko**

**Co-Chairman of the
Extended
Programme
Committee and
Programme
Committee,
Director General of
PJSC “Nikopol
Ferroalloy Plant”**



Vladimir Kutsin

**Chief Executive
Officer of UkrFA**



**Sergey
Kudryavtsev**

**WELCOME TO INFACON XIV IN KYIV, UKRAINE, ON BEHALF OF THE
INTERNATIONAL COMMITTEE ON FERRO-ALLOYS (ICFA)**

It is with great pleasure that we extend, on behalf of ICFA, our very warm welcome to all the delegates, sponsors, and other participants at Infacon XIV in Kyiv in May/June 2015.

The hosting of Infacon XIV was initiated and organised by the Ukrainian Association of Ferroalloys and other Electrometallurgical Products Manufacturers (UkrFA).

ICFA believes that all participants will enjoy the 14th International Ferro-Alloys Congress that is being hosted for the first time in Ukraine, and also appreciates the valuable contributions you will make during both the technical and social programme and your support for the exhibition and post-Congress tours.

ICFA would like also to express our sincere appreciation to the Infacon XIV Organising and Technical Programme Committees as well as to all those who have assisted them with the planning, promotion, organising and hosting of this important international event.

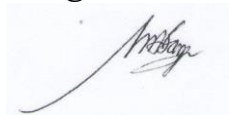
ICFA would like to thank the Chairman of Infacon XIV, Professor Sergey Grishchenko, and his team for the dedication that they have shown to arranging Infacon XIV since June 2013 when it was awarded to Ukraine at the ICFA meeting held during Infacon XIII in Almaty, Kazakhstan.

ICFA would like to thank the UkrFA for making the commitment to host Infacon XIV, and to also express our appreciation to Sergey Kudryavtsev and Natalya Legkaya, Director of the Public Association Infacon XIV. We feel sure that ICFA's acknowledgement to the Organising Committee and their team is endorsed by all participants at Infacon XIV.

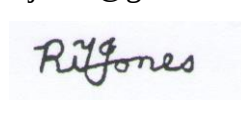
The International Committee on Ferro-Alloys (ICFA) plans to hold its next meeting during Infacon XIV, and will announce the host for Infacon XV during the closing ceremony of this Congress on 3 June 2015.

We look forward to a truly interesting technical and a most enjoyable social programme in Kyiv during Infacon XIV, as well as the support of all the ferro-alloys producers, and a maximum level of participation from all the ferro-alloys producing regions.

Dr. NA Barcza
Chairman, ICFA
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RT Jones
Secretary General, ICFA
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Secretariat of the International Committee on Ferro-Alloys
Mintek, 200 Malibongwe Drive, Private Bag X3015, Randburg, 2125, South Africa



Greetings from SMS Company – Platinum sponsor of INFACON 14

SMS is delighted to be the platinum sponsor for this year's Infacon Congress. This traditional congress is a perfect platform to get actual information regarding markets, key technologies and other important topics related to the ferroalloy industry.

For the near future, the metal market prospective seems to be stable. The ferroalloy prices of most metals are driven by the constant growth in the steel industry. SMS is quite optimistic to benefit from some good business opportunities in the upcoming years.

Recent past years have been exciting for the smelter department of the SMS group. Many interesting and challenging furnace projects were and are currently being implemented, including the world's largest FeNi-furnaces ever built, the first large scale FeCr-production line based on DC-technology, silicon plants, copper slag cleaning furnaces, FeMn plants, FeNb furnace, smelters for the production of fused magnesia as well as large-scale calcium carbide furnaces to name a few.

The SMS group including SMS Siemag in Düsseldorf, Metix in Johannesburg and Paul Wurth in Luxemburg is well prepared to satisfy the growing market demand for its smelter technology and auxiliaries. The SMS Group will present some of our competences in the papers.

As our customers are requesting for complete solutions, therefore we have enhanced our competences in this field as well supplying projects on turnkey basis and then managing them on EPCM basis.

Our customers can expect the top quality we have always supplied for more than 100 years from our SAF departments combined with enhanced up- and downstream equipment/process for a full-line solution.

We look forward to meeting you and discussing about the existing projects, market trends and other issues.

Enjoy the Congress!

Dr. Rolf Degel

INFACON XIV COMMITTEES

Boris Paton - the honorary Co-Chairman, Academician, the President of the National Academy of Sciences of Ukraine;

Sergey Grishchenko – the Chairman of the INFACON XIV Congress, UkrFA, Doctor of Technical Sciences, Professor, Ukraine.

Organizing Committee

Pavel Kravchenko - The Chairman of the Organizing Committee, Chairman of the Board of Directors of the UkrFA, Chairman of the Board of PJSC “Zaporozhye Ferroalloy Plant”, Ukraine;

The members of the Committee

Vladimir Kutsin – the Chairman of the Board, General Director of PJSC «Nikopol plant of ferroalloys», Doctor of technical Sciences, Ukraine;

Yurii Dedov, Scientific Secretary of INFACON XIV, PJSC "Nikopol plant of ferroalloys", Candidate of Technical Sciences, Ukraine;

Dmitry Stalinsky - General Director of SE "UkrRTC "Energostal", Doctor of technical Sciences, Professor, Ukraine;

Vladimir Soloshenko - Chairman of the Board of JSC «Stakhanov Ferroalloy plant», Ukraine;

Sergey Shuvaev- Chairman of the Board of JSC "Ordzhonikidze ore mining and processing enterprise"; Ukraine;

Alexander Zilberman- Chairman of the JSC "Marganetsk mining plant", Ukraine;

Oleg Besspalov- General Director LLC "Pobuzhsky ferronickel plant", Ukraine;

Sergey Kudryavtsev, Executive Director of the UkrFA Ukraine;

Natalia Legkaya - Director of the Public Association INFACON XIV, Ukraine.

Program Committee

Sergey Grishchenko - the Chairman of the Committee, UkrFA, Doctor of technical Sciences, Professor, Ukraine;

Vladimir Kutsin Co - Chairman, Chairman of the Board, General Director of PJSC “Nikopol Ferroalloy Plant”, Doctor of Technical Sciences, Ukraine;

Yurii Dedov, Scientific Secretary of INFACON XIV, PJSC "Nikopol Ferroalloy Plant", Candidate of Technical Sciences, Ukraine;

The members of the Committee

Mikhail Gasik, Academician of the NASU, Doctor of Technical Sciences, Professor, NMetAU, Ukraine;

Alexander Velichko, Member-corr. of the National Academy of Sciences of Ukraine, Rector NMetAU, Doctor of Technical Sciences, Professor, Ukraine;

Peter Loboda, Member-corr. of the National Academy of Sciences of Ukraine, dean of “Kiev Polytechnic Institute”, Doctor of Technical Sciences, Professor, Ukraine;

Dmitriy Stalinskiy -, General Director of SE "UkrRTC "Energostal", Doctor of Technical Sciences, Professor, Ukraine;

Anatoliy Ovcharuk – NmetAU, Doctor of Technical Sciences , Professor, Ukraine;

Lev Medovar - the Head of the Department of the Paton Electric Welding Institute of NAS of Ukraine, Doctor of Technical Sciences, Professor, Ukraine;

Vladimir Granovskiy -, Vice-President of the Ukrainian Association of metallurgical enterprises. Candidate of Technical Sciences, Ukraine;

Dmitry Belokurov -, Director General of the Ukrainian Association of metallurgical enterprises, Candidate of Technical Sciences, Ukraine;

Nikolay Gizenko - General Director of “Ukrnon-ferrousmet”, Candidate of Technical Sciences, Ukraine;

Vladimir Shevchenko - Director of NPPO “Topaz”,Candidate of technical Sciences, Ukraine;

Victor Sivachenko - the Head of the laboratory of the Institute “Ukrniispetsstal”, Candidate of Technical Sciences, Ukraine;

Anatoliy Grinev - Director of Institute “Ukrmetinform”, Chief Editor of journal “Metallurgical and mining industry”, Professor, Ukraine;

Natalya Legkaya - Director of the Public Association INFACON XIV, Ukraine.

Extended Program Committee

Sergey Grishchenko - the Chairman of the Committee, UkrFA, Doctor of Technical Sciences, Professor, Ukraine;

Vladimir Kutsin - Co-Chairman, Chairman of the Board, Director General of PJSC “Nikopol Ferroalloy Plant”, Doctor of Technical Sciences, Ukraine;

The members of the Committee

Nicolas Barcza - the Head of the International Committee for ferroalloys, MINTEK consultant, SA;

Rodney Jones - General Secretary of the International Committee for ferroalloys, MINTEK Mintek& SAIMM; SA;

Manat Tolymbekov - Chemical-metallurgical Institute, Member-corr. of the National Academy of Sciences of Kazakhstan, Doctor of Technical Sciences, Professor, Kazakhstan;

Sergey Kim - Chemical-metallurgical Institute, Candidate of Technical Sciences, Kazakhstan;

Vladimir Zhuchkov - Institute of Metallurgy Ural branch RAS, Doctor of Technical Sciences, Professor, Russia;

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Alexander Zhdanov - Ural State University, Doctor of Technical Sciences , Professor, Russia;

Ines Van Lierde - Euroalliages, Secretary General, Belgium:

Oleg Ostrovskiy - School of Materials Science and Engineering University of New South Wales,
Doctor of Technical Sciences, Professor, Australia

Sergey Kudryavtsev, Executive Director of the UkrFA, Ukraine.

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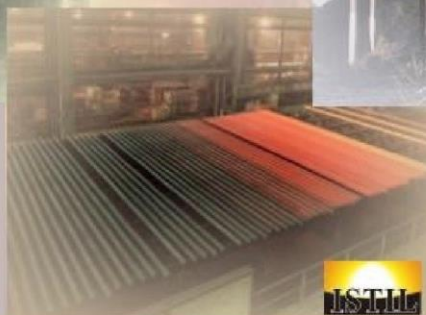
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ФЕРРОСПЛАВОВ
И ДРУГОЙ
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