



INFACON XII 2010

The Twelfth International Ferroalloys Congress • June 6-9 • Helsinki, Finland

Proceedings of
**THE TWELFTH INTERNATIONAL
FERROALLOYS CONGRESS**

Sustainable Future

June 6 – 9, 2010
Helsinki, Finland

EDITED BY:
Asmo Vartiainen

Published by Outotec Oyj

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FOREWORD

This publication records the proceedings of the Twelfth International Ferroalloys Congress, INFACON XII, held in Helsinki, Finland on June 6- 9, 2010. The Proceedings serve as a valuable record of the papers presented at this important event.

The Congress theme 'Sustainable Future' is very appropriate at the prevailing world situation in 2009 and 2010. The ferroalloy industry has suffered from the global economic recession calling for ever improved production efficiency. At the same time, demands for concrete measures to respond to global warming have been growing. The papers presenting research work and improvements in design and operating practises are among the topics addressed at INFACON XII and in these Proceedings. The theme reflects the innovations and development required in the ferroalloy industry and the essential role that technology plays in coping with the challenges ahead.

The call for papers was well received and altogether 128 abstracts of very good quality were sent for review. The Program Committee accepted preliminary 120 papers for the evaluation of competent referees.

The Proceedings of INFACON XII contain 97 papers, of which 78 papers to be presented in twentyfive Sessions, by authors from 22 countries. The major ferroalloys, namely ferrochromium and ferromanganese, are covered extensively in many interesting papers. Papers on ferronickel, titanium oxide, silicon and ferrosilicon ensure that all the large-volume ferroalloys are addressed.

These Proceedings will be available both in a printed and electronic form with search function.

All papers included in these Proceedings were pre-reviewed by at least two referees. About 80 referees were sourced internationally, and their valuable technical and editing inputs are gratefully acknowledged. We appreciate the time and effort that the authors and referees have devoted to making this publication a really valuable document.

When INFACON XII was honoured to Finland, for the first time, a group representing Outotec Oyj, Outokumpu Oyj, Aalto University, University of Oulu and Confedent International Oy was formed for the practical organising work. We appreciate these organisations for providing highly competent persons to the Organising and Programme committees. To achieve a broader perspective for the organising work, an international Extended Programme Committee was nominated. We are grateful for the contributions of the members of the Committee.

Finally, I would like to thank the members of the Organising Committee and the Program and Extended Program Committees, led by Dr. Kari Knuutila as well as the Congress Secretary Dr. Asmo Vartiainen and Ms. Eila Paatela, whose contribution for publications and other congress preparation was essential. Without the tireless efforts of these individuals and their Committee members, the technical programme and these Proceedings would not have been the success they certainly are.

Jorma Daavittila

Chairman: INFACON XII Organising Committee

WELCOME TO INFACON XII IN HELSINKI FINLAND ON BEHALF OF THE INTERNATIONAL COMMITTEE ON FERRO-ALLOYS (ICFA)

On behalf of the International Committee on Ferro-alloys (ICFA) it gives me great pleasure to welcome all the contributors to and participants at INFACON XII in Helsinki. I would in particular like to acknowledge the leading role of the Chairman of the INFACON XII and the Organising Committee as well as the enormous efforts of all the INFACON XII Sub-Committees in the build-up to INFACON XII over the past three years. The record contribution of high quality and very relevant manuscripts bears testimony to their excellent efforts and to the choice of a topical theme, namely 'Sustainable Future'.

The Programme Committee, chaired by Kari Knuutila has had a major task with reviewing the numerous abstracts that were submitted and the subsequent refereeing process that is so essential to maintaining and even improving the high technical standards set in the past by previous INFACON Congresses. It is particularly pleasing that INFACON XII has attracted contributions from Russian speaking regions such as Kazakhstan, the Ukraine, and Russia itself. The ICFA Committee requested the Organising Committee of INFACON XII to pay special attention to the need to grow the involvement from the region and their special efforts have been rewarded.

ICFA awarded INFACON XII to Finland based on the excellent presentation given at its Committee meeting in Delhi at INFACON XI. It is gratifying to have seen the very well planned and thoroughly organised management of the activities in the build-up to INFACON XII. With most previous INFACON Congresses this role has been fulfilled by a Professional Association. However in the case of INFACON XII this role has been filled largely by Outotec Oyj (with valuable contributions from Outokumpu Oyj and Aalto University and University of Oulu) who should be acknowledged and sincerely thanked for this tremendous and much appreciated invaluable support for INFACON XII. Special mention should be made of the Chairman, Jorma Daavittila, the Chairman of the Programme Committee, Kari Knuutila, and the Congress Secretary, Asmo Vartiainen, and all their fellow Committee Members. The innovation of forming an INFACON XII Extended Programme Committee to assist with the planning and implementation of the Congress is an excellent one that I feel sure future INFACONs will embrace.

The ICFA Committee plans to hold its next meeting during INFACON XII and announce the host for INFACON XIII planned for 2013 at the end of INFACON XII. We look forward to a truly interesting technical and a most enjoyable social programme during INFACON XII as well as the support of all the ferro-alloy producers and the maximum level participation from all the ferro-alloy producing regions.

Nic Barcza, Chairman ICFA (International Committee on Ferro-alloys)

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