

## Guest Editorial

# Fray International Symposium on Metals and Materials Processing in a Clean Environment: Part I

It is a privilege and a pleasure to be invited to guest edit a special issue of *Mineral Processing and Extractive Metallurgy*, which presents a selection of the best papers delivered at the Fray International Symposium on Metals and Materials Processing in a Clean Environment. The papers will be published in two parts; with part I in this issue and part II focusing mainly on slag processing in Volume 123 Number 1 2014.

The Fray Symposium, held in Cancún, Mexico, from 27 November to 1 December 2011, was organised to honour the distinguished work and lifetime achievements of Professor Derek J. Fray FRS FREng, who is well known for his significant impact in the area of materials extraction and processing and, especially, for developing new and sustainable technologies.

Throughout his career, Professor Fray has provided unique contributions to various disciplines, including ferrous and non-ferrous metallurgy, hydro- and pyrometallurgy, materials recycling, nanomaterial production, chemical sensors and others. He has authored or co-authored approximately 400 scientific publications, is named as an inventor on numerous patents arising from more than 60 patent families and has created a range of university spin-out companies. He is a Fellow of several of the world's most prestigious professional bodies.

The overarching theme of the Symposium was the role of science and technology in the sustainable future development of the world. The Symposium was organised by FLOGEN Star Outreach, a non-profit international organisation dedicated to bringing achievements related to global sustainable development to the attention of the worldwide society, and was sponsored by a record number of around 240 organisations.

The plenary sessions of the Symposium were based on the 'sustainability triangle' developed by Symposium Chair Dr Florian Kongoli, representing education, politics and technology. In line with this, three plenary sessions were held: academics reflecting the role of education for an engaged society; politicians discussing the importance of legislation in view of today's pressing environmental concerns; and industrialists from several major corporations evaluating the role of technology in a commercial and societal context. This Symposium was thus the first one ever to include politicians and industrialists in a mostly technical setting.

The technical programme of the Symposium was unusually wide, covering fundamentals, technologies and industrial practice. It was subdivided into 12 individual events, addressing topics as diverse as: iron and steel making; non-ferrous smelting; titanium for wide applications; silicon for photovoltaic applications; boron and borates; composites, ceramics and nanomaterials; aqueous and low temperature processing; electrochemical processing; molten salts and ionic liquids; materials recycling; environmental, health, energy and policy issues; and legal, management, economical and social issues. The overwhelming response from the professional community was manifested by some 500 submissions from authors in 80 countries.

It was an extremely difficult task to select articles for this special issue, given the number and breadth of the contributions. Those featured are very much at the heart of the Symposium's major theme and concern crucial aspects of materials processing with a view to ensuring the sustainable future supply of strategic resources.

In part I, the first paper by Fray summarises some of the technologies he developed, emphasising especially the fact that the solutions to imminent technological challenges often fall 'outside the immediate field of the problem'. Mohandas then provides an up to date and most comprehensive review of the FFC-Cambridge process, one of Fray's more recent achievements that uses molten salt electrochemistry to directly convert metal oxides into the corresponding metals. Schwandt illustrates that, despite the straightforward concept underlying the FFC-Cambridge process, a deep understanding of its fundamentals is required to bring the process to fruition in a reliable and efficient manner. Chao *et al.* then discuss the winning of metals by other reduction techniques, such as sodium and hydrogen reduction. Refining materials is another key aspect of materials processing. Free *et al.* demonstrate how electrolytic refining of copper can be optimised by combining experimental and modelling techniques and, finally, Meteleva-Fischer *et al.* study a new method of converting metallurgical grade into solar grade silicon by alloying with calcium.



1 Professor Derek J. Fray FRS FREng delivering a plenary lecture at the Symposium held in his honour

Many other contributions would have had the scientific merit to be included in this, inevitably space limited, special issue. The complete set of presentations is available in the proceedings of the conference, published by FLOGEN Star Outreach™ and edited by F. Kongoli as 'Metals and Materials Processing in a Clean Environment'. A full conference report is given in <http://www.min-eng.com/pyrometallurgy/rep/10.pdf>.

### Guest Editors



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