

Arunansu Haldar
Satyam Suwas
Debashish Bhattacharjee
Editors

Proceedings of the International Conference on

Microstructure and Texture in Steels and Other Materials

February 5–7, 2008, Jamshedpur, India

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Editors

Arunansu Haldar, Dr.
Tata Steel Ltd.
Jamshedpur-831001
India
arunansuhaldar@tatasteel.com

Debashish Bhattacharjee, Dr.
Tata Steel Ltd.
Jamshedpur-831001
India
dbhattac@tatasteel.com

Satyam Suwas, Asst. Prof.
Indian Institute of Science
Department of Materials Engineering
Bangalore-560012
India
satyamsuwas@materials.iisc.ernet.in

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Department of Mining & Materials Engineering
McGill University
M.H. Wong Building
3610 University Street
Montreal, Quebec, Canada
H3A 2B2

Professor John J. Jonas, OC, CQ, FRSC
Birks Professor of Metallurgy Emeritus
Tel: (514) 398-1649
Fax: (514) 398-4492
e-mail: john.jonas@mcgill.ca

Foreword

I am sometimes asked, when presenting a paper on “Recent advances in steel processing”, whether, after a century and a half of research on steels, there is anything left to discover. “Hasn’t everything there is to know been determined by now?” they say. My usual answer is to quote Albert Einstein’s reply on such occasions. This great scientist would simply say: “When the radius of knowledge expands, so does the circumference of ignorance”. In fact, because of the linear relationship between radius and circumference, he was actually understating the extent to which the boundary between the ‘known’ and the ‘unknown’ expands with the progress of science. Perhaps he should have used the radius of a *sphere* to typify what is known or even that of a 4- or 5-dimensional sphere! Then the area of the interface would have increased much more rapidly.

This is made clearly evident when we turn to the papers presented at the Jamshedpur *International Conference on Microstructure and Texture in Steels 2008 (MATS2008)*.

In this case, the twenty three invited papers and eleven contributory papers, which are collected in these proceedings, display an impressive depth and novelty that would have intrigued old Albert, if he could be with us. Although swords have been made for centuries, with age-old lore about effective quenching methods, we are still learning fascinating things about martensite, its properties, and how to produce it. When it comes to deformation, we have now entered into the realm of “severe plastic deformation”, and are uncovering hitherto unimagined

properties and characteristics of our strained samples. I wonder whether asymmetric rolling will become a process that can be employed in industry. Similarly, are we likely to be able to develop practical and useful methods for making ultrafine grain steels?

There is so much going on in the field of textures. Some of the remarkable advances in 3D x-ray diffraction have been described here. With the progress that continues to be made in the power and speed of computers, the simulations carried out using the methods of crystal plasticity are leading to greater and greater insights into the behaviour of metals. The widespread availability of electron back-scattered diffraction (EBSD) attachments in electron microscopes has taken metallography to previously unattainable new heights! We can now obtain simultaneous, detailed topological and crystallographic information and even perform in situ tests (both mechanical and thermal) in such equipment! Details of some of these approaches have been presented at this conference and are included in the proceedings.

Part of the fascination of steel research lies in the complexities of the microstructures involved. In addition to austenite, ferrite and martensite, we must also be able to take into account effects arising from the presence of pearlite, bainite, various precipitates, inclusions, grain boundary segregants, and more recently, even twins! And then there are the nanocrystalline structures, which have distinct properties of their own. There is almost no limit to the number of microstructures we can study.

Examination of the papers in this volume will convince even the sceptic that the radius of our sphere of knowledge has been considerably extended during the recent past and that, as a result, the interface with the unknown has been stretched even further.

McGill University
August 14, 2008

John J. Jonas

A handwritten signature in black ink, appearing to read "John J. Jonas". The signature is stylized with large, sweeping loops and a prominent initial "J".

Preface

This volume is a collection of papers presented at the International Conference in “Microstructure and Texture in Steels” held in Jamshedpur between 5–7th of February 2008.

Texture and microstructure, besides chemistry, are key factors that control properties of engineering materials. The design of any engineering product needs proper knowledge of these two parameters. Texture and Microstructure evolve during thermo-mechanical processing of materials. These processes constitute the most important steps in product fabrication schedule, especially for steels for automotive application. It is, therefore, quite natural that they should be the subject of intensive research. Hence the theme selected for this international conference was microstructure and texture in steels. This conference was organized jointly by R&D, Tata Steel and the Indian Institute of Metals, Jamshedpur Chapter, on the occasion of centenary celebration of Tata Steel and 70 years of the company’s Research & Development Division.

In recent times, the science of processing of steels has acquired new dimensions. The quest for stronger and more formable steels has led to new approaches towards optimal design of material and components. Effect of steel processing on evolution of texture and microstructure are being studied with renewed interest. In particular, the advent of new techniques such as orientation imaging microscopy, local texture determination by synchrotron radiation and new approaches in modelling and simulation of microstructure and texture have led to deeper understanding of this subject. In this conference, each of these aspects was covered at length by experts in these fields.

This conference also covered new developments such as production of ultra-fine grains or nanostructured materials. Also covered was research on materials other than steels, as they highlighted the mechanisms and use of modern characterisation tools.

The contents of this volume have been structured to suit the convenience of the readers. Papers in the introductory section are on fundamentals of texture and

microstructure of steels. These also include emerging fields such as grain boundary engineering.

The second section deals with topics on applied research on microstructure and texture control in steels. This section includes bulk as well as surface characteristics, such as coating and design of new steels for specialised applications and new concepts of microstructure design.

The third section is dedicated to modelling of texture and microstructure. This is followed by a section on specialized characterisation techniques for microstructure and texture examination.

The next section contains papers on special processes and materials. Some papers on the exotic materials like iron aluminium have also been included.

In addition to the invited papers, this volume also includes papers contributed by research scholars from various countries.

Since materials covered in the book are non-steel as well, the book has been named as 'Texture and Microstructure of steels and other materials'.

We hope that the reader will find in this collection an up-to-date account of current issues, concepts, techniques and thoughts related to the science of texture and microstructure.

We are indebted to all the speakers who had accepted our invitation and have taken the pain of traveling from different parts of the globe to attend and share their knowledge with us. We are thankful to the delegates as well as their sponsoring organisations for showing their interest and to the sponsors of this conference for encouraging the efforts. We are indeed grateful to the Indian Institute of Metals, for jointly organising this conference and to the publishers, Springer Link Pvt. Ltd., for kindly agreeing to publish the proceedings. Last but not the least, thanks to all those who worked in the background to make the conference a great success.

The editors wish to thank the Management of Tata Steel for their encouragement and support.

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