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Preface

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Nanostructured materials may be defined formally as polycrystalline solids having structural components or substructures lying within the nanoscale range of 1–100 nm in at least one dimension. These materials are currently attracting considerable interest in the scientific community because of their unique characteristics including superior physical, mechanical, chemical, optical, electrical, magnetic and other properties. As a consequence of this very widespread interest, it was decided to collect and integrate a series of papers to form a special issue of the *Journal of Materials Science* devoted exclusively to several of the significant research topics in this field. This issue, entitled *Nanostructured Materials—Processing, Structures, Properties and Applications*, contains the papers collected for this special issue.

Many of the papers in this issue are concerned with the processing and testing of bulk nanostructured metals and alloys for structural applications. These materials are fabricated primarily through various processing procedures in which large fully-dense solids, having relatively large grain sizes, are subjected to severe plastic deformation (SPD) so that intense strains are imposed without introducing any significant changes in the overall dimensions of the solid. Various SPD processing procedures are now available but the most important techniques at the present time are equal-channel angular pressing (ECAP), high-pressure torsion (HPT) and accumulative roll-bonding (ARB). All of these SPD processes are capable of producing bulk nanostructured materials that are fully-dense, free from flaws and contaminants and sufficiently large that they may be used for real structural applications. Furthermore, these bulk nanostructured metals and alloys often exhibit superior mechanical properties such as much higher ductility by comparison with those produced by other techniques such as nano-powder consolidation. For this reason, this research topic has attracted a very dynamic and ever-growing scientific community.

It is important to note that the metals and alloys produced by SPD processing usually have grain sizes larger than 100 nm. Nevertheless, many of the substructural features, such as subgrain sizes and dislocation cell sizes, are generally smaller than 100 nm. For example the coherent-domain sizes of these materials, determined by X-ray diffraction, usually have dimensions of only several tens of nanometers. Accordingly, it is convenient to follow conventional practice and refer to these materials as *nanostructured* materials.

All of the papers in this issue dealing with bulk nanostructured metals and alloys are invited contributions coming from some of the leading researchers in the field. To provide an even broader perspective, and

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especially to incorporate some information on functional nanomaterials, the last eight papers in this special issue are based on contributions made at a special symposium entitled *2006 Nanomaterials: Materials and Processing for Functional Applications* which was organized as part of the 2006 TMS Spring Meeting held in San Antonio, Texas, U.S.A. on March 13–16, 2006. For convenience, and recognizing that there are some overlaps between the various subject areas, the papers on nanostructured metals and alloys are arranged with the sequence of fundamentals, processing, characterization, microstructure and properties.

The Guest Editors of this special issue would like to take this opportunity to thank all of the many contributors for their hard work, cooperation and especially for their willingness to respond quickly and efficiently to the various comments and queries raised by the reviewers. As always, every paper was subjected to a rigorous review procedure to ensure accuracy and high standards. We hope that our readers will share our enthusiasm for the quality of the many papers in this special issue and that they will enjoy having an up-to-date overview of the many topical areas currently under investigation within the broad framework of nanostructured materials.