DEVELOPMENT OF ADVANCED MATERIALS USING NANOPARTICLES / NANOTECHNOLOGY

INNOVATIONS, ADVANCES, APPLICATIONS AND EMERGENCE

A Special Issue in Honor of

Dr. Manoj Gupta
[Editor-in-Chief]

CURRENT NANOMATERIALS

EXECUTIVE GUEST EDITORS

Dr. T. S. Srivatsan** **and Dr. K. Manigandan++**
[Professor (Emeritus); ++ Associate Professor]**
Department of Mechanical Engineering
THE UNIVERSITY OF AKRON
Akron, Ohio, USA

Bentham Science Publishers
(Sharjah, United Arab Emirates)

DEVELOPMENT OF ADVANCED MATERIALS USING NANOPARTICLES / NANOTECHNOLOGY

INNOVATIONS, ADVANCES, APPLICATIONS AND EMERGENCE

A Special Issue in the Journal CURRENT NANOMATERIALS

In honor of

Dr. Manoj Gupta

[Editor-in-Chief]

CALL for PAPERS

Nanostructuring is the new and promising method for enhancing the properties of a wide range of metals, alloys and their composite counterparts for a spectrum of advanced structural and functional applications spanning the domains of both performance-critical and non-performance critical. To date, it is well established that bulk nanostructured materials [BNMs] can be produced successfully through microstructural refinement using severe plastic deformation [SPD], which is heavy straining of the chosen material under conditions of high imposed pressure. Severe plastic deformation [SPD] processing is an attractive procedure for many advanced applications as it significantly enhances the properties of wide range of metals, alloys and their composite counterparts. Metallic materials subject to severe plastic deformation [SPD] can possess not only an ultrafine grain (UFG) structure but also specific nano-structural features, such as non-equilibrium grain boundaries, nano-twins, grain boundary segregation and nanoparticles. The emergence of nanostructured materials led them to be defined as solids with grains, sub-grains, twin or dislocation cells with sizes less than 100 nm. Such materials usually have a combination of superior mechanical properties and physical properties to include high strength, improved corrosion resistance and good wear resistance. Over the years, two complimentary approaches have been developed for synthesizing nanostructured solids. The first is the "**BOTTOM-UP**" approach, in which the nanostructured materials are assembled from individual atoms or from nanoscale building blocks, such as nanoparticles. The second is the "**TOP-DOWN**" approach in which existing coarse grained materials are processed to produce substantial grain refinement and nanostructure.

The most successful "**TOP-DOWN**" approaches involve the application of large plastic deformation, in which the chosen material is subject to large plastic strains typically larger than 4-6. The plastic deformation tends to refine the grains by a combination of several concurrent and competing mechanisms to include dislocation glide, dislocation accumulation, dislocation interactions, dislocation annihilation, tangling and spatial rearrangement. For materials with medium Stacking Fault Energy and low Stacking Fault Energy, deformation twinning does play a significant role, especially for the grains in the nanocrystalline size range. The details specific to microstructural evolution does tend to vary with the following: (i) nature of chosen material, (ii) deformation mode, (iii) strain rate, and (iv) temperature. The goal of both understanding and controlling materials at the nanoscale led to noticeable advances in technology with tangible societal benefits. The early hype with specific reference to the benefits offered by nanotechnology led to several meaningful applications ranging from: (i) medical instruments, (ii) to high performance computers and data storage, (iii) to high efficiency energy conversion, and (iv) storage devices. In the early days, news articles specific to the benefits of nanotechnology far outpaced the number of awarded patents. However, this trend gradually reversed and successful nanotechnology patents and

products now outnumber the popular "news" stories. The emergence of nanotechnology did inspire several grand challenges listed by the U.S. National Academy of Sciences to be the following:

(a) Increase the five-year survival rates by 50 percent for the most difficult to treat cancers.
(b) Create devices no bigger than a grain of rice that can sense, compute and communicate with wires and be maintenance free for at least 10 years, enabling in a revolution of "internet of things".
(c) Create computer chips that are 100 times faster yet consume less power.
(d) Manufacture atomically precise materials with 50 times the strength of pure aluminum but at half the weight and same cost;
(e) Reduce the cost of turning sea water into drinkable water by a factor of four, and
(f) Determine the environmental, health and safety characteristics of the chosen nanomaterial.

The objectives of this "**special-issue**" of the journal of "**CURRENT NANOMATERIALS"** being dedicated in honor of the *Chief Editor* **Dr. Manoj Gupta** (of National University of Singapore) is to bring together a collection of technical papers that reflect on the noticeable and commendable progress that has been made in the domain specific to innovations, developments and applications of the family of nanomaterials. The focus on nanoscience, nanomaterials and nanotechnology has greatly advanced both our ability and capability to synthesize, characterize and engineer nanomaterials having a unique combination of physical, chemical and mechanical properties that are made possible by providing constraints to the dimensions. In applications related to technology where the engineered components must bear load, structural nanomaterials show much promise and put to use the trend/concept "smaller is stronger". This "**special issue**" of **CURRENT NANOMATERIALS** will bring together a collection of papers that provide adequate information specific to state of the art developments on all aspects related to processing, characterization and fabrication of nanomaterials and nanostructures for a spectrum of metals, inter-metallic, ceramics, ceramic-matrix composites, metal matrix composites, and including the domain of both surface coatings and high temperature coatings. The primary objective of this "special issue" is to present important results to both the material-related community and technology-relevant community in the form of technical papers that address aspects specific to innovations in research, development, applications, design and technological applications. The collection of papers assembled would assist researchers, scientists, engineer's manufacturers and potential end-users to keep themselves abreast with new developments in their area of specialty while concurrently making efforts to come together in an attempt to bring forth novel innovations in technology and resultant applications. The topics of interest for inclusion in this "special issue" of the journal of **CURRENT NANOMATERIALS**, but not restricted and open are the following:

Materials

Bio-materials
Ceramics
Ceramic Matrix Composites
Functionally-graded materials
Intermetallic,
Metals
Metal-matrix composites
Superconducting materials
Surface coating and thin films

Manufacturing

Additive manufacturing (AM)r
Advanced casting
Digital manufacturing
Forming
Friction stir processing
Grinding and finishing
Machining
Microwave processing
Powder metallurgy
Welding and Joining

All technical manuscripts on the above materials and appropriate manufacturing technique chosen can make a mention of applications in industries spanning automotive, aerospace, marine (Naval), defense, biomedical, health care, electronics, communication, energy storage and heavy equipment to include machinery. The collection of papers to be included in the "Special Issue" of the journal will attempt to

provide a cohesively complete and compelling overview of recent developments to include innovations and advances in the specific domain of nanomaterials and nanotechnology, concurrent advances in the processing and characterization of these novel materials, emerging developments and potential far-reaching applications for these materials commensurate with advances in both engineering and technology. The "Special Issue" will in essence contain about 12 to 14 well-written and laid-out technical manuscripts. The 12 to 14 manuscripts chosen will attempt to cover a broad spectrum of the family of nanomaterials.

We certainly anticipate that this "**Special Issue**" on **CURRENT NANOMATERIALS** (CNMs) [in honor of Dr. Manoj Gupta (National University of Singapore)] to be of valued interest to academicians, scientists, engineers, technologists and entrepreneurs.

Executive Guest Editors

Dr. T. S. Srivatsan
Professor [Emeritus]
The University of Akron
Akron, OHIO, USA

Dr. K. Manigandan
Associate Professor
The University of Akron
Akron, OHIO, USA

IMPORTANT DATES:

- **FIRST DRAFT of manuscript due by** **September 30, 2020**
- **Notification of Acceptance to Authors** **October 30, 2020**
- **REVISED version from Author(s) due by** **November 30, 2020**
- **Manuscripts to publisher:** **December 20, 2020**