Preface

The study of nanomaterials is an active area of research in physics, chemistry, and materials engineering as well as biomedical engineering in the 21st Century. Nanomaterials which are categorized as substances that are in the shape of spherical dot, rod, thin plate, or void of any irregular shape smaller than 100 nm, find wide application in materials science and technology due to their very distinctive properties compared to their bulk counterparts. Depending on the size of the building blocks of their constituent structural elements, they can be classified as: zero- (0D), one- (1D), two- (2D) and three-dimensional (3D). Nanomaterials can be in the form of composites, alloys, compounds or pure elemental solids and sometimes referred to as nanostructured materials, nanosolids, nanoclusters, nanocrystallites, nanograins, etc., and the term nanotechnology refers to the methods used for the construction of nanomaterials and nanodevices. The key difference in properties of nanomaterials compared to their bulk counterparts arise due to the difference in interatomic interactions which arise due to high surface-to-volume ratio and a high portion of undercoordinated surface atoms when the particle size approaches nanometer range. The size dependent properties of solids are very challenging to study both theoretically and experimentally.

This special volume is focused on two fundamental issues related to the stability of nanomaterials. The thermal stability of nanomaterials is a very important issue for controlling the size during synthesis as well as in high temperature application environments where as, the thermodynamic stability of nanomaterial is very important in order to understand the underlying principle behind its formation either from atomic or molecular constituents through the bottom-up approach (where nanomaterials are formed from atoms or molecules as starting materials and the starting species are enlarged to nanometer size) or from disintegration of larger particles through the top-down approach (where nanometer size materials are obtained by disintegration of larger particles). Large variation in thermo-physical properties like melting points, enthalpy of formation etc. have been observed for nanomaterials compared to their bulk counterparts. The underlying principles behind these anomalous properties have been addressed in some of the articles in this volume. We hope, the articles published in this special volume will provide many important inputs to researchers to address fundamental and technical issues in the field of nanomaterials.

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Guest Editor