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Particle size versus energetics of nanomaterials: Key parameters controlling the stability and reactivity of nanostructured materials

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Due to the unique and unusual physical and chemical properties of the systems and structures at the nanoscale, the understanding of their stability and reactivity, presents a host of questions and problems. The dimension-dependent properties or phenomena may be used for functional effects, the nanotechnology taking advantage of this by designing property modifications for applicative reasons. At the same time, research to date suggests that some engineered nanomaterial's will present hazards, thus challenging many conventional approaches related to nanosafety area. Because this is an emerging scientific issue, to identify key parameters important for evaluating the possible benefits as well as risks is a central point in the research activity with impact in the materials science. In the present paper will be argued that control of the energetic parameters and the understanding of their crossover when working at the nano-level are important steps in understanding the nanomaterial stability and the possibilities to interaction with the biologic systems. Some compounds from specific systems were selected for Discussion: nanostructured transition metal oxides; Nano alloys, bio-nonbio systems. Several conclusions can be drawn from the characterization data obtained so far: •Exploring the relationships between different compositional variables and thermodynamic properties of Nano crystalline transition metal oxides we obtained that particular behavior of these materials could be explained not only qualitatively by the structural changes, but also by the fact that the energetic properties are extremely sensitive to the chemical defects in oxygen sites. •Investigating the metastable phases of Nano alloys synthesized by severe deformation non-equilibrium methods we obtained that the energetic parameters may be used to explain the experimentally observed stability in particular temperature ranges associated with the growth process of nanometer-sized samples. •The evaluation of the thermodynamic parameters describing the nanoparticle - protein interaction is a key issue for the bio-reactivity of nanomaterial's having a great impact in nanosafety research.

The control of the energetic parameters: important step in understanding the stability and reactivity of nanostructured materials

Biography

Speranta Tanasescu is Head of the Laboratory of Chemical Thermodynamics in the Institute of Physical Chemistry "Ilie Murgulescu" of the Romanian Academy, Bucharest. She received his Ph.D. in Physical Chemistry – Romanian Academy in1979; the thematic research area is oriented on activities with impact in the following domains: materials science, nanoscience and nanotechnologies, new sources of energies, nanosafety, nanomedicine etc. The obtained results by her group are significant for both the understanding of processing-structure relationships, as well as for finding key parameters in relation to bio-reactivity of the nanomaterial's with mpact in nanosafety research.

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