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J Nanomed Nanotechnol 2017, 8:5 (Suppl)
DOI: 10.4172/2157-7439-C1-053

Surface structure in nanoscaled solids: The influence on physical and technological effects

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Surface physics has been one of the important subjects in material science due to its importance in understanding the electronic transport, optical properties and applications lead to the electronic devices beginning from the design of metal-semiconductor and p-n junction diodes. To understand why surface properties, differ from that of the internal bulk state, the structure knowledge formation is to be known. In this talk we try to figure out and build the structure formation for the solid surface which is 5-6 nm thick. It has been known that when the surface to internal bulk solid ratio reaches 10% and more, material properties begin to change, in this case for example melting temperature reduces to zero at a critical size of about 2nm for Si nanoparticle diameter at zero Kelvin. In this seminar, the equation to calculate the size dependence of lattice volume will be derived. Equations for calculating first surface layer height in solids, the nanosize dependent melting temperature and entropy of melting will also be given and explained. There are two critical nanostructure sizes points; first the structure change from crystalline form to that of molecular like formation occurs at diameters 3-4 nm and the second is the transformation to a liquid state at 6 h, for 'h' be the first surface layer height. Applications to these equations will be given as an example on elementary and compound semiconductors including III-V, II-VI as well as some technological important materials such as Au. The expected solid surface structure form as a function of nanoscale size will be shown. Technological important parameter values such as melting temperature, thermal and optical properties as a function of nanosize dependence for zero, one and two-dimensional materials also included in the talk.

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