Nanocomposites and nanomaterials

Relaxation contact phenomenes in nano-materials

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The main peculiarity of nano-crystalline materials is that contact areas which are always have special properties occupy significant volume parts of each grain and the material as whole. That substantially effects on the material properties. In the present work, physical mechanisms of some effects related with scale-structure peculiarity (granularity) of nano-materials are discussed (changing charge state in nano-size grains in connection with redistribution of electrical charge at the interface, synthesis of new phases, changing magnetic properties of transition metals, changing electrical and optical properties).

The last investigations show that the mentioned influence is really observed, and its degree of manifestation increases with reducing the grain size in the material. For example, in [1] it was noticed that in the ferroelectric inclusion of a ferroelectric-dielectric nano-composite, beginning from some grain size there takes place the transition into a ‘domain-like’ state with peculiarities of dielectric permittivity. Peculiarities like these were observed in any other works [2-4]. In [5], Ga-In nano-material polymorphism was observed.

On the base of quantitative evaluations and the discussion, a general conclusion can be as follows. Varying the main parameters of a nano-structured material (grain size and composition) it is possible to change controllably phase and structure states as well as many physical properties of such material.

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