

Nanocomposites and nanomaterials

Contact Phenomena in Intergranular Boundaries of Composite Nano-Materials

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Possible mechanisms of some phenomena in composite nano-materials are considered; the degree of their manifestation increases as the grain size decreases. [1]. Taking into account the fact the contact areas always possessing specific properties take up most of volume of each grain and of the whole volume of the material as the grain size decreases [1-7], the degree of the specific properties manifestation also grows with grain size decrease [7]. It seems natural to study the regularities of this phenomenon in connection with relaxation processes at the electron level in the contact areas of nano-grains [1-7].

We consider a nano-composite material formed by grains of metallic and semiconductor substances with different charge volume densities in the conduction band and, respectively, different Fermi energies.

Based on evaluations of valence electron states for neighboring heterogeneous atoms we show that in the contact area, the solid-state plasma (SSP) consisting of mobile free electrons and periodically oscillating positive ions is formed. This movement results in variation of valence electron concentration per an atom. The less is the size of nano-crystal grains, the larger is variations of valence electrons density and Fermi surface contours. When Fermi surface is close to Brillouin zone boundary, transformation of lattice symmetry and changing of its parameter is often observed [4].

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