"Nanocomposites and nanomaterials"

On the size distribution function in three-dimensional quantaum dot crystals

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The size distribution of nano-dots has been calculated for artificial three-simensional quanatum-dot crystals (Si)Ge/Si and In(Ga)As/GaAs [1,2]. Nano-dots of pyramidal shape are modelled as cone-shape clusters, for which the Thomson formula is obtained that is necessary for finding the rate of growth (dissolution) of clusters under the Ostwald's ripening. Comparison of the results of calculation with experimental data is provided [3]. The absence of asymmetric arm for small sizes shows that nano-dots of Ge under the gage self-organization regime can be formed not only at strictly specified locations of holes but also spontaneously at other locations, to say at cells between holes of a matrix. However, spontaneously formed nuclei of nano-dots of Ge with pre-critical size ($r < r_k$, homogeneous forming nuclei) are progressively dissolved and vanish during the concurring growth. The only nano-dots of Ge remain, which were formed at points of strict positioning of the matrix of holes having initial supercritical size ($r > r_k$, heterogeneous forming nuclei). It means that in the case of the gage self-organization and using the two-dimensional hole matrix, the initial size distribution function can be transformed into the Lifshitz–Slyozov distribution. Thus, narrow size distribution function is formed under evolution of nano-crystals at all stages of growth, being caused by the peculiarities of forming quantum dots of Ge and InAs at preliminary textures substrates Si and GaAs.

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