Nanocomposites and nanomaterials

Ostwald ripening of nanodispersed phases considering several growth mechanisms

R.D. Vengrenovich, B.V. Ivanskii, I.I. Panko

Yuriy Fedkovych Chernivtsi National University, 2 Kotsjubynskyi Str. Chernivtsi 58000, Ukraine

E-mail: igaroshapanko@gmail.com

Within the framework of a modified theory of Lifshitz-Slezov-Wagner (LSW theory) [1] it was shown that the growth (dissolution) of the particles in the process of Ostwald ripening (OR), provided the simultaneous action of two mechanisms of growth - diffusion and Wagner, it is more common than their growth, when implemented separately, each of the mechanisms. This is especially characteristic for nanodispersed systems in which the OR in the vast majority occurs simultaneously on the two indicated mechanisms of growth. At the same time, however, the question arises, what to do in case of metallic systems in which clusters growth can occur in the conditions dislocation diffusion, ie, diffusion along dislocations?

Therefore, we have proposed one possible mechanism growth (dissolution) nanoparticle phase formation(creation) in metal alloys, at the stage OR, controlled simultaneously matrix diffusion, which corresponds flux j_v, diffusion along the dislocation, characterized by the flux j_d, and the rate of formation of chemical bonds (chemical reaction) due to kinetic flux j_i. The total flux of atoms involved in the formation of chemical bonds on the surface of the cluster : $j = j_v + j_d + j_i$. Comparison of experimental histograms Ni_3Al nanocrystals in $CuNi_{15}Al_5$ alloys, and Al_3Li nanocrystals in $Al-Li$ alloys, with the theoretically calculated curves indicate their good agreement.

1. *Vengrenovich R.D., Ivanskii B.V., Moskalyuk A.V.* Generalized Lifshitz-Slyozov-Wagner distribution // JETP. – 2007, – Vol. **131**, №6, – P. 1040-1047.