**Nanocomposites and nanomaterials (2019)**

**The influence of the size factor on the formation of eutectic**

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We consider a binary system (A - B) of a refractory compound. The thermodynamic potential of the system is constructed as the sum of the interaction energy between the elements A and B (*UAA, UBB, UAB*) . The eutectic parameters (concentration and melting point) were obtained from the extremum condition of the thermodynamic potential [1]. Considering that for bulk materials, the surface fraction is small compared to the volume part, the influence of external surfaces is not taken into account when calculating the physical characteristics of the system. In the transition to limited (nanoscale) materials, it is necessary to take into account the influence of external surfaces on the physical properties of crystals. The influence of the external surface on the internal states of ions and electrons was estimated by us by averaging the energy of neighboring layers in the presence of close-packed atomic planes [2], in their absence, such as, for example, in the LaB6 - MeB2  system, a new method is proposed, the essence of which is as follows: for the components LaB6 and MeB2, the energy of the outer surface is determined on the basis of the value of the total energy of the electron-ion system of the unit cell. Let the outer surface of the LaB6 - MeB2  nanoplate coincide with the basal plane of the unit cell MeB2 and the faces of the cubic LaB6. We distribute the total energy of the electron-ion system, which arrives at one unit cell, uniformly along the faces, and we obtain an estimate of the energy that comes to one facet of the unit cell.

To estimate the interfacial interaction energy, taking into account the presence of an external surface, we introduce the concept of a virtual cell including the interface of joining two components, with an average volume of the volume of two components. If we assign a cubic structure with the parameter *a*\* to a virtual cell, then . Here *СЕ0*  is the eutectic concentration of bulk materials, *а*0 is the parameter of the cubic lattice, *a* and *c* are the parameters of the hexagonal lattice. To estimate the energy of a nanocrystal, we use the averaging method for crystals with close-packed atomic planes, assuming that the energy is averaged over two neighboring cells, but not over atomic planes. As a result, we obtain the energy value per cell depending on the distance of the outer surface (implicitly expressed in the cell number). Let us sum this energy over all unit cells located along the thickness of the nanoplate and divide by the number of cells. We obtain the final formulas for the average value of the interaction energy of the components, taking into account the size of the nanoplate - *d*:

 (1),

где , *KAA*=a0/6, *KAB* = *a*\**/6.*

The method of calculating the eutectic concentration and temperature for nanocomposites is the same as for bulk materials, but only with new values ​​of the interaction energy between the representative elements of the components (1). The relation (1) implicitly takes into account an increase in the root-mean-square displacement of atoms at small sizes, and a decrease in the Debye temperature. Calculations show that a decrease in the size of the composite leads to an increase in the concentration fraction of the reinforcing phase and to a decrease in the temperature of the eutectic. The functional dependence of the normalized eutectic concentration *CE/CE0* (*CE* - is the concentration of the component of the eutectic composition of the nanomaterial) and temperature on the size of the composite is the same for different two-component systems.

1. Zakarian D., Kartuzov V., Khachatrian A. Powder Metallurgy and Metal Ceramics. Springer - 2009. - Vol. 48, № 9-10 . – P.588-594.

2. Zakarian D., Kartuzov V., Khachatrian A. AIMS Materials Science. - 2016, 3(4): 1696-1703. doi: 10.3934/matersci.2016.4.1696.