Nanoobjects microscopy

Free energy of electron subsystem of biintercalate

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Foreign atoms or molecules inserted into the layer crystal behave themselves to a certain extent as independent system preserving almost the same features as before their insertion. Such atoms form monolayer planes in the van der Waals gaps. It allows us to consider them as flat nanostructures. So intercalation as a way of the nanoplanes formation is caused by i) specific structure of the crystal layer structure - existence of different interstitial hollows (IH) in the van der Waals gap, ii) atoms of the most different features can be inserted, iii) inserted atoms can occupy different IH.

Free energy of electron subsystem of biintercalate depending on Fermi energy is calculated. As we reported before [1], density of electron states of layered crystal intercalated by guests of different nature possesses the several peculiarities: in particular, the appearance of the additional gap ($=_1 p_1 +_2 p_2$, p_i – average intercalant concentrations in corresponding states) and its shift or disappearing depending on the position of the ground energy states of these atoms. Received results allowed to study the thermodynamical properties of intercalated layer crystals at low temperatures. It was found [2] in the case of intercalation by one type of guest that depending on the position of ground energy level of guest electron (the localized or resonance one) the different regions of Fermi energy are thermodynamically advantageous for the intercalation process.

In the case of biintercalation, the thermodynamically favorable regions are significantly narrowed. At certain concentrations and at the location of Fermi energy between corresponding states $_1$ and $_2$, the thermodynamically favorable region is broadened. The case is studied when such an effect disappears.

1. Tovstyuk N.K., Sheregiy Ye. M. // Acta Physica Polonica A, 2015, N11
2. Tovstyuk N.K. // Low Temperature Physics.- 2004.- v.30, N6.- P.672-678.