Nanocomposites and nanomaterials

Cluster approach to orientational order of CO-Ar solid solutions

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Molecular cryocrystals made of linear molecules have orientationaly order phase. The symmetry of these crystals is described by the *Pa3* space group in which the centers of molecules are located at the sites of the **fcc** lattice and the molecular axes are directed along the space diagonals of the unit cell [1]. Anisotropic forces are responsible for the orientational order which may be changed by the doping spherically symmetric particles. Dilute quadrupolar system based on diatomic linear CO molecules is convenient object to investigate disorder solid, orientational glass states.

Under equilibrium vapor pressure the low temperature CO phase has the cubic lattice. Pa3 symmetry is observed "*on average*". It associated with the CO asymmetry and its nonzero dipole moment. According structural studies CO dipoles form a disordered structure in the dipole subsystem. The CO-Ar solid solutions have the **fcc** lattice for Ar-rich solutions, or a *Pa3* structure for alloys rich in the molecular component. The aim of presented study is to investigate the binary carbon monoxide-argon alloys on the base of the cluster approach.

Observations were carried out in a standard electron diffractograph equipped with a helium cryostat (THEED). . The samples were grown *in situ* by depositing gaseous mixtures on Al or C substrate at T=20 K. The deposition regime was chosen in order to obtain random distributions of impurity. Measurements were made at temperatures from 5 K to the sublimation temperature of argon. The error in the lattice parameter measurements was usually 0.1%.

There is the correlation between a degree of orientational order in the CO-rich phase and the character of the diffraction peak intensity. Using the cluster model, the formation of solid CO-Ar solutions has been studied. Based on the experimental data the influence of pair and triple clusters on the lattice parameter and orientational order in the CO matrix has been investigated.

1. . *V.G.Mangelii, Yu.A.Freiman, M.L.Klein, A.A.Maradudin* (eds.) The Physics of Cryocrystal,// AIP Press, Woodbury (1997).