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VARIABLE MAGNETISM OF COBALT-FULLERENE MIXED SYSTEM

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Great activity in spintronics-related fields in recent few years revealed importance in combining magnetic metal nanoparticles and organic semiconductor that promises new nanomaterials with attractive magnetic and electronic properties. Here, we demonstrate the remarkable nanocomposites, formed through self-assembling in the cobalt-fullerene mixture, which exhibit tunable magnetism. The CoxC60 films (x<120) were fabricated by simultaneous deposition of Co and C60 onto the same substrate under controlled conditions. We found that magnetic properties of the films strongly depends on the Co concentration x. The Co_xC_{60} films with x<2 demonstrate a ferromagnetic behaviour. At higher x (x>2), the films become superparamagnetic. Such a magnetic transformation correlates with the changes in the film nanostructure. In the interval of x<2, the film nanostructure consists of the bulk fcc-C_{60} and Co_2C_{60} phases only. At higher x (x>2), the Co clustering occurs, and the film is a nanocomposite (NC) as the arrays of small Co clusters (few nm in size) distributed in the C_{60}-based matrix. Parameters of the NC (size and fraction of the Co clusters) designate the features of the superparamagnetic effect (coercive field, saturation magnetization, blocking temperature T_b). Remarkable changes in the film magnetism occur upon the air exposure of the $CoxC_{60}$ films. In particular, magnetization of such films revealed vertical shift of the hysteresis loops suggesting the effect of interface exchange magnetism. In the interval of x>30, the oxygen content in such films is dropped down as well as Tb is increasing that reflects coalescence of the Co clusters. The CoxC60 films with x>40 show ferromagnetic behaviour at room temperature that allowed us to detect their magnetic domains using magnetic force microscopy. The discovered magnetism of the Co_xC_{60} films designates their potential for application in high-dense magnetic memory, sensors and catalysis

Biography

Vasily Lavrentiev has completed his PhD in 1984 from Leningrad Polytechnic Institute (St. Petersburg, Russia). He received Postdoctoral experience in Institute of Applied Physics (Sumy) and Institute of Physics at Augsburg University (Augsburg). His activity in nanoscience has been started from 2000 in Japan Atomic Energy Research Institute (Takasaki). Presently, he is a Researcher of Nuclear Physics Institute CAS. He has published more than 140 papers in reputed journals.

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