Ferromagnetic behavior of polymeric C60

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C60-based materials exhibit a number of important physical properties: superconductivity, ferromagnetism, nonlinear optical activity, and ultrahardness. In this series one can mention the experimental evidence of a room-temperature magnetically ordered state in fullerenes, polymerized by pressure [1-3], or by light [4], as well as in hydrofullerites [5].

There have been dozens of reports on room-temperature magnetism in carbon-based structures [6], but poorly reproducible results cast doubts on the intrinsic nature of magnetism. After the first observation of a finite spontaneous magnetization in polymerized fullerenes, similar results were obtained by several groups. Studies of the room-temperature fullerene-based magnets show that the fullerene cages are not damaged in structures exhibiting the ferromagnetic transition. A recent observation of a magnetic domain structure by means of magnetic force microscopy in impurity free parts of samples gives a strong argument in favor of the intrinsic character of ferromagnetism in polymerized fullerenes. [7].

Here we present the results on pressure-polymerized fullerenes, as well as on fullerite modified by laser exposure and electron beam. The observed regularities in the appearance of ferromagnetic order and visualization of magnetic domains can improve our concept on the mechanism for the origin of magnetism in carbon-based materials.

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