Two-dimensional magnetism of fluorinated graphite

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A series of layered inclusion compounds based on fluorinated graphite C_2F_x ($x \leq 1$) was obtained by a room temperature synthesis. Electronic and magnetic properties of graphene sheet can be delicately tuned by the fluorination degree and the nature of the inclusion compound in the layered fluorographene compounds. Magnetic phase transitions have been observed using both magnetic susceptibility measurements and electron spin resonance. The changes in C_2F_x stoichiometry are shown to have a decisive effect on magnetic properties of produced complexes. The spin concentration decreases with the increase of fluorine content in fluorocarbon matrix.

As prepared fluorinated samples have groups of correlated spins; at the temperatures 1.75–5 K nonlinear magnetization is observed, indicating a high-spin state. Application of the Langevin formula shows that the clusters consiSt of 10–20 interacting spins.

The outer layers of graphite fluoride can be reduced by water present in the atmosphere, and graphene layers are formed. New magnetic features appear: large orbital diamagnetism, the difference between the measurements in field cooled and zero field cooled regimes, and characteristic kinks at the zero field cooled curves reveal the temperature at which magnetic moments become blocked. However, superparamagnetic description is not applicable to this system. The temperature dependence of the magnetization M(T) above a transition temperature takes the form $M(T) = M_0 [1- AT \ln(\beta T)]$, typical for two-dimensional systems. ESR line below the transition point splits into the in-plane and out-of-plane contributions. The semifluorinated graphite provides a unique opportunity to study the magnetism of two-dimensional system without metallic impurities