Intrinsic ferromagnetism induced by hydrogen adsorption on graphite surfaces

Juan J. Palacios[1], Mohammed Moaied[1], Jose V. Alvarez[1], Maria J. Caturla[2]

[1]Universidad Autónoma de Madrid, Campus de Cantoblanco, Madrid 28049, Spain
[2]Universidad de Alicante, Campus de San Vicente del Raspeig, Alicante 03690, Spain

juanjose.palacios@uam.es

Abstract

A remarkable theoretical prediction for graphene is that, in theory, it can be permanently magnetized by the adsorption of H atoms (see figure). Unfortunately, this will only be possible if the adsorption is selectively realized in such a way that all H atoms occupy the same sublattice so that the contributions of the H-induced local magnetic moments add up due to the expected ferromagnetic coupling in this situation. Motivated by a recent experiment, I will show that such selectivity can be naturally achieved on the graphite surface. Due to the sublattice broken symmetry on the surface, a spontaneous arrangement of the hydrogen atoms where all end up adsorbed on the same sublattice takes place at room temperature in a time scale of minutes. First-principles calculations combined with kinetic Monte Carlo simulations and model Heisenberg-like Hamiltonians derived from them give a complete account of the emergence of this novel ferromagnetism.

References

[1] Iván Brihuega, Miguel M. Ugeda, Mohammed Moaied, Héctor González-Herrero, María J. Caturla, José M. Gómez-Rodríguez, Juan J. Palacios, submitted to ACS Nano.

Figure. Intrinsic magnetism induced by H adorption on graphene.