Organometallic optoelectronically-active magnetic molecules for logic and memory

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Molecular logic gates and atomic circuits offer the potential not just for smaller, faster and cheaper conventional computer circuitry, but also for entirely new functionalities taking advantage of the interplay between different physical phenomena including electric fields, geometry, magnetic order, photon absorption and emission, and charge transfer, to perform logic, memory, and other operations. Here, we present the results of combined SPM and DFT investigations of organometallic optoelectronically active magnetic molecules which are based on aza-BODIPY derivatives. Aza-BODIPY molecules have a tunable infra-red absorption and function as electron donors in organic solar cells [1, 2]. By changing the central metal atom, both magnetic and non-magnetic examples of this molecule can be synthesized, and the magnetic molecules with a central Co atom show evidence of a possible spin-crossover effect. The spin-crossover effect is where external factors such as temperature or an applied electric field [3] change the spin configuration of a system, which in turn changes its electronic transport properties. Thus, this molecule can be used as a memory element in a two-terminal set-up, where a high applied bias is used to perform write operations and a low bias to perform read operations. Alternatively, by changing the alignment of the molecule in the junction and adding a gate electrode to the system to control the spin-configuration, a transistor can be created.

References

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