Magnetic Molecular Films for Spintronic Applications

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Molecular materials present exciting advantages for spintronics and quantum technologies, due to their long spin-lifetime, relative ease of processing and chemical and structural flexibility [1-4]. In this talk, the ability to grow ferromagnetic semiconducting molecular thin films on flexible substrates will be presented. The molecules of choice are iron phthalocyanines (FePcs), polyaromatic molecules that are commonly used in optoelectronic applications and possess significant advantages in terms of multifunctionality and processability. By treating the substrates with a molecular template, we are able to orient the films and exploit their strong magnetic anisotropy, as well as tune their Curie temperature. [5] Magnetisation measurements are analysed using concepts and formulas with broad applicability to all one-dimensional ferromagnetic chains, and rationalized using solitons. Furthermore, organic vapour phase deposition is used to create FePc nanowires, consisting of quasi one-dimensional chains aligned along the long axis [6], which have recently demonstrated excellent charge transport properties [7]. The wires present an enhanced Tc of around 40 K, which could be attributed to the change in the crystal structure, as has been observed for other Pcs. Even more importantly, the wires show a dramatically enhanced coercivity up to values above which is extremely promising for potential future spintronic applications, and the talk will conclude with perspectives on implementation into device structures.

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