Magnetic Characterization of Ferromagnetic Metal/Organic Semiconductor Interfaces

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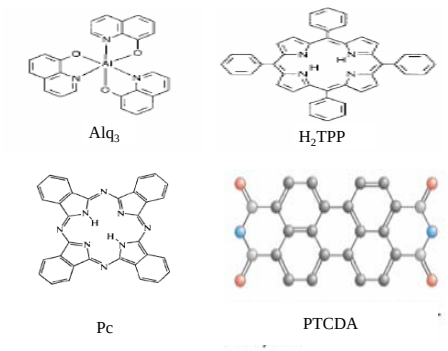
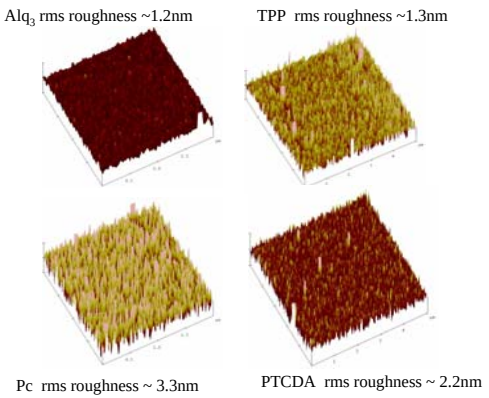
Abstract

The interface between ferromagnetic metals and organic films plays a important role in the performance of hybrid spintronic devices. We report the magnetic characterization of Co thin films on top of a series of well-known organic semiconductors, namely Alq_3, TPP, Pc and PTCDA. Cobalt thin films were deposited under high vacuum by electron beam evaporation and capped with a 5 nm layer of Al. After each deposition the samples were removed from the vacuum system and hysteresis loops were measured at 300 K with an alternating gradient magnetometer to determine the coercivity (H_c)and saturation magnetization (M_s).

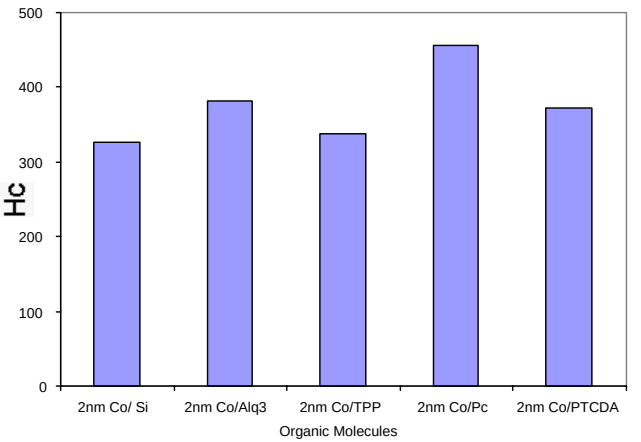
Molecular structures



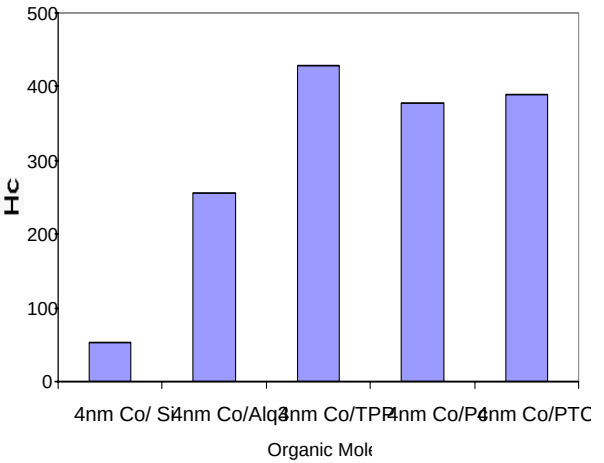
AFM images of 50nm organic films on Si wafers



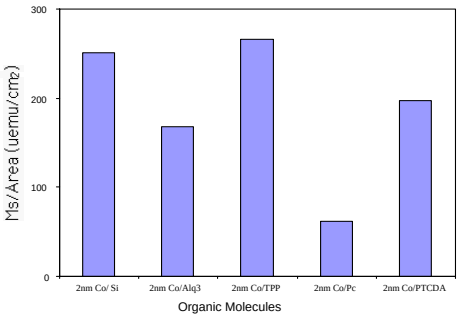
Coercivity of 2nm Co films on different organic molecules



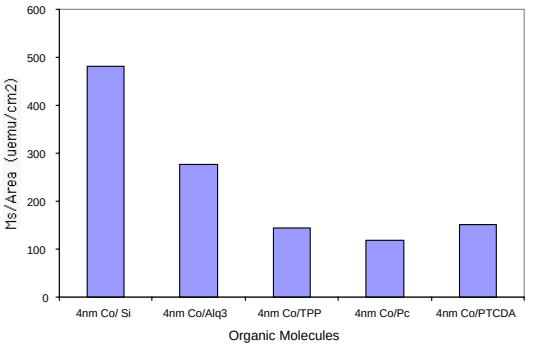
Coercivity of 4nm Co films on different organic molecules



M_s of 2nm Co films on different organic molecules



M_s of 4nm Co film on different organic molecules



Conclusions

-The coercivity of 4 nm Co films on the organic films is much larger than a 4 nm Co film on a Si wafer, which is likely determined by a reduced dimensionality and lower Curie temperature. AFM images support this conclusion, since a rougher organic surface produces the larger coercivity for the Co film.

-The saturation magnetization of the Co films deposited on top of organic molecules is smaller than the valve observed on a Si wafer, which indicates the presence of dead magnetic layers. The dead layer is larger on a rough organic film.

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