Tuning the (anti)ferromagnetic coupling of MPcs/Gr/FM spin interfaces

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Paramagnetic metal organic molecules can open the route to engineer spintronic devices when their magnetic moments are stabilized against thermal fluctuations, e.g. by a controlled interaction with a magnetic substrate. We report on robust spin interfaces, exhibiting residual magnetic coupling up to room temperature (RT), with tunable (anti- or ferromagnetic) alignment. This is enabled by an optimized configuration of the magnetic support, a Gr substrate intercalated with ferromagnetic metals/alloys (Fe,Co,FeCo), and molecular units with suitable symmetry of the molecular orbitals carrying the magnetic moment. The (anti)ferromagnetic response of the spin interface is determined by a symmetry-selected superexchange path, actively mediated by the Gr sheet and the organic backbone of the MPc molecules (Fig.1 and Ref.[1]).

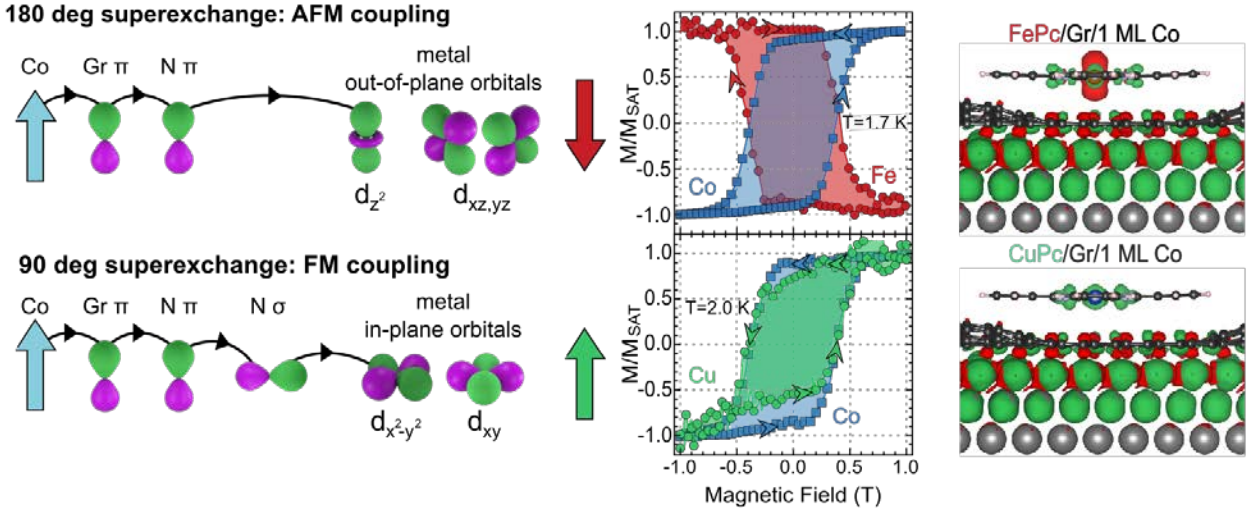

Fig.1. Left panel, sketch of the two available super-exchange paths determining an A- or FM MPc-Co alignment, respectively. Central panel, element-resolved hysteresis loops for the FePc/Gr/Co and CuPc/Gr/Co interfaces, unveiling the different spin alignment. Right panel: spin density isosurfaces as obtained by theoretical calculations, confirming and supporting the experimental results.

Combined optimization both of the magnetic state of the substrate and of the super-exchange channel open an incredible playground for the nanomagnetism scientific community.

References

[1] Avvisati G., Cardoso C., Varsano D., Ferretti A., Gargiani P., Betti M.G. *Nano Letters* **18**, 2268-2273 (2018)