5 Conclusion

In this work we have presented two molecular systems: the $TbPc_2$ and the Fe_4Ph SMMs. Both of them can be sublimated allowing the preparation of hybrid surfaces employing the ultimate cleanliness of the UHV environment.

$TbPc_2$ is considered the archetypal of sublimable SMMs and the ideal candidate for investigations with scanning probe techniques. However, we have demonstrated that its magnetic properties are strongly influenced by the surrounding environment. We have indeed proven that its slow relaxation of the magnetization depends on the molecular packing. Despite the many experiments performed by us and others a rationalization of its properties and a full comprehension of the role played by the exchange interactions is lacking. Nevertheless $TbPc_2$, thanks to its relative high blocking temperature, is an interesting candidate for OSPDs. Moving toward this type of applications we have investigated the role played by the presence of a magnetic conducting substrate in the hysteretic behaviour of the $TbPc_2$. Our study has concerned metallic cobalt and LSMO, two of the most employed ferromagnetic electrodes employed in molecular spin valves. The results we have presented here suggest that no significant polarisation of the $TbPc_2$ magnet moments is induced by the magnetic Co and LSMO substrates. However, this does not diminish the interest in this type of molecules, and magneto-transport experiments on devices embedding $TbPc_2$ molecules are likely to be the focus of this research in a near future.

On the other hand Fe_4Ph molecules show a more predictable magnetic behaviour and, albeit the low blocking temperature of the system that makes them less appealing for OSPDs, the investigation of its electron transport properties could allow to have a reliable picture of the role played by magnetic molecules at the interface between the ferromagnetic electrodes and the organic semiconductor.

Within this framework we have exploited the sublimation of Fe_4Ph in order to be able to investigate the hybrid surfaces by means of STM and STS techniques.

Our characterisation has allowed to address the spin excitation signal of an isolated Fe_4Ph molecule. This first important step opens new possibility for the investigation of the magnetic and electronic properties of this rich and versatile class of SMMs at the single molecule level.