

1. Introduction	1
2. Experimental methods	9
2.1 Bulk magnetic characterisation	9
2.1.1 Standard magnetometry	10
2.1.2 Ac susceptometry and dynamic properties investigation	12
2.2 Sublimation process	14
2.3 Quartz Crystal Microbalance (QCM)	16
2.4 Photoelectron Spectroscopy (PES)	16
2.4.1 X-ray Photoelectron Spectroscopy (XPS)	20
2.4.1.1 Auger emission	23
2.4.2 Ultraviolet Photoelectron Spectroscopy (UPS)	24
2.5 X-ray absorption spectroscopy (XAS)	25
2.5.1 X-ray synchrotron radiation	26
2.5.2 X-ray absorption spectroscopy principles	27
2.5.3 X-ray Magnetic Circular Dichroism (XMCD)	29
2.5.3.1 Sum rules $2p \rightarrow 3d$	31
2.5.4 X-ray Natural Linear Dichroism (XNLD)	32
2.5.5 X-ray absorption detection	33
2.6 DEIMOS beamline	34
2.7 Low Energy Ion Scattering (LEIS)	35
2.8 Scanning Probe Microscopy (SPM)	37
2.8.1 Scanning Tunnelling Microscopy (STM)	37
2.8.2 Tunnelling effect	38
2.8.3 Scanning Tunnelling Spectroscopy (STS)	42
2.9 Multiplatform Ultra High Vacuum (UHV) system	43
2.9.1 Sublimation chamber	44
2.9.2 XPS, UPS and LEIS chamber	44
2.9.3 STM Omicron system	44
3. The Terbium(III) bis(phthalocyaninato) (TbPc₂) complex	47
3.1 Introduction	47
3.2 Erratic magnetic hysteresis	50
3.2.1 TbPc ₂ synthesis	50

3.2.2	Microcrystalline $[\text{TbPc}_2]^0 \cdot \text{CH}_2\text{Cl}_2$ hysteresis	52
3.2.3	Sublimation process: TbPc_2 hysteresis transformation	53
3.2.4	TbPc_2 in magnetic dilution environment	58
3.2.5	Evaluation of the exchange interaction	61
3.2.6	Magnetic Circular Dichroism (MCD) on TbPc_2 sublimated on quartz	63
3.3	Characterisation of thick films through low-energy implanted muons	65
3.4	Toward TbPc_2 spintronic devices	76
3.4.1	Introduction	76
3.4.2	$\text{TbPc}_2/\text{LSMO}/\text{STO}$ hybrid surface	78
3.4.3	$\text{TbPc}_2/\text{Co}/\text{Cu}(100)$ hybrid surface	83
3.4.3.1	<i>In house</i> experiment	84
3.4.3.2	XAS characterisation	87
4.	The Fe_4 SMM class	99
4.1	Introduction	99
4.2	Thick film characterisation	102
4.3	Preparation and XPS characterisation of Fe_4Ph deposited on $\text{Au}(111)$ at low coverage	106
4.4	STM characterisation of Fe_4Ph sub-monolayer on $\text{Au}(111)$	109
4.4.1	Back exposure sublimation test	112
4.5	STM investigation on $\text{Cu}(100)$ surface	113
4.6	STM investigation on $\text{Cu}_2\text{N}/\text{Cu}(100)$ surface	115
4.7	STS and IETS measurements	117
5.	Conclusion	127