

LIST OF FIGURES

Figure 1.1: Schematic band structure of a ferromagnetic metal showing the energy band spin-splitting	3
Figure 1.2: Schematic for spin dependent conduction through independent spin up and spin down channels in the limit of negligible spin mixing	4
Figure 1.3: Schematic representation of the experimental layout for electrical spin injection. A current I is flowing through F/N interface. The arrows indicated with λ_F and λ_N on either side of the F/N interface represent the distance where the spin accumulation exists in the F and N metal	6
Figure 1.4: Spin Polarization	7
Figure 1.5: Schematic illustration of (a) the current in plane (CIP), (b) The current perpendicular to the plane (CPP) in Giant Magnetoresistance geometry	8
Figure 1.6: Schematic illustration of electron tunneling in ferromagnet / insulator / ferromagnet (F/I/F) tunnel junctions: (a) Parallel and (b) antiparallel orientation of magnetizations with the corresponding spin resolved density of the d states in ferromagnetic metals that have exchange spin splitting.....	9
Figure 1.7: Three types of semiconductors: (A) a magnetic semiconductor, in which a periodic array of ordered spins is present; (B) a dilute magnetic semiconductor: a nonmagnetic semiconductor to which a dilute concentration of ions carrying an unpaired spin has been added; and (C) a nonmagnetic semiconductor [4]	11
Figure 1.8: ZnO wurtzite structure showing the positions of Zinc and Oxygen atoms and axes direction.....	13
Figure 1.9: Different forms of TiO_2 : (A) Rutile, (B) Anatase and (C) Brookite	14
Figure 1.10: GMR structure [22]	15
Figure 1.11: Schematic representation of a MRAM with MTJ.....	17
Figure 1.12: Scheme of the Datta-Das spin field-effect transistor (SFET) [24]	18
Figure 1.13: A schematic spin LED [25].....	19
Figure 2.1: Flow chart describing various steps involved in solid-state reaction	37
Figure 2.2: Weighing Machine	38
Figure 2.3: Microprocessor controlled Muffle Furnace.....	38
Figure 2.4: Hydraulic press unit	39
Figure 2.5: Flow chart describing various steps involved in sol-gel method.....	40
Figure 2.6: Schematic diagram of X-ray diffraction from matter [6]	43
Figure 2.7: X-Ray Diffraction.....	45
Figure 2.8: Positron Annihilation diagram	49

<i>Figure 2.9: Decay scheme of ^{22}Na.....</i>	<i>49</i>
<i>Figure 2.10: Block Diagram of experimental setup used for the Positron lifetime measurement. 50</i>	
<i>Figure 2.11: Raman Transitional Schemes.....</i>	<i>52</i>
<i>Figure 2.12: Raman Spectrometer.....</i>	<i>54</i>
<i>Figure 2.13: Schematic diagram of Raman Spectrometer.....</i>	<i>54</i>
<i>Figure 2.14: Superconducting Quantum Interference Device (SQUID) magnetometer</i>	<i>56</i>
<i>Figure 2.15: Schematic diagram of a SQUID measurement system [15]</i>	<i>57</i>
<i>Figure 2.16: Circuit Diagram of SQUID.....</i>	<i>57</i>
<i>Figure 2.17: Superconducting detection coil (pick-up loop).....</i>	<i>58</i>
<i>Figure 2.18: UV-VIS-NIR Spectrophotometer Perkin-Elmer Lambda750.....</i>	<i>61</i>
<i>Figure 3.1: XRD pattern for (a) Pure ZnO sample (b) 1% Mn doped ZnO sample (c) 2% Mn doped ZnO sample (d) 3% Mn doped ZnO sample (e) 5% Co doped ZnO sample (f) 10% Co doped ZnO sample</i>	<i>75</i>
<i>Figure 3.2: (a, b): X-ray diffraction pattern of Mn/Co doped ZnO samples</i>	<i>76</i>
<i>Figure 3.3: The Positron lifetime measurement spectra for the (a) 1% Mn doped ZnO sample (b) 2% Mn doped ZnO (c) 3% Mn doped ZnO (d) 5% Co doped ZnO (e) 10% Co doped ZnO, the graph shows the plot between counts versus the channel number.....</i>	<i>79</i>
<i>Figure 3.4: (a, b): Raman Spectra for (a) Raman Spectra for Pure and Mn (1-3%) doped ZnO sample, and (b) Raman Spectra for Pure and Co (5 and 10%) doped ZnO sample</i>	<i>82</i>
<i>Figure 3.5: Absorption spectra of a) Pure ZnO sample (b) 5% Co doped ZnO sample (c) 10% Co doped ZnO sample</i>	<i>84</i>
<i>Figure 3.6: Absorption spectra of $\text{Zn}_{1-x}\text{Co}_x\text{O}$ ($x=0.00, 0.05$ and 0.10).....</i>	<i>85</i>
<i>Figure 3.7: Absorption spectra of a) Pure ZnO sample (b) 1% Mn doped ZnO sample (c) 2% Mn doped ZnO sample (d) 3% Mn doped ZnO sample.....</i>	<i>87</i>
<i>Figure 3.8: Absorption spectra of $\text{Zn}_{1-x}\text{Mn}_x\text{O}$ ($x=0.00, 0.01, 0.02$ and 0.03)</i>	<i>88</i>
<i>Figure 3.9: (a, b): Variation in the bandgap of (a) Co doped ZnO polycrystalline with Co concentration. (b) Mn doped ZnO with Mn concentration</i>	<i>90</i>
<i>Figure 4.1: XRD pattern for (a) Pure TiO_2 sample (b) 1% Mn doped TiO_2 sample (c) 2% Mn doped TiO_2 sample (d) 3% Mn doped TiO_2 sample.....</i>	<i>105</i>
<i>Figure 4.2: Fitted XRD patterns of $\text{Ti}_{1-x}\text{Co}_x\text{O}_2$ ($x=0.00, 0.05$ and 0.10). The observed (calculated) profiles are shown by open circles (solid line) curves. The short vertical marks represent Bragg reflections and the lower curves are the difference (solid line) plot.....</i>	<i>106</i>
<i>Figure 4.3: Best fitted XRD patterns of $\text{Ti}_{1-x}\text{Co}_x\text{O}_2$ ($x=0.00, 0.05$ and 0.10) in a limited range, depicting the relative changes in the peak position of the most intense (101) reflection. The observed (calculated) profiles are shown by open circles (solid line) curves. The short vertical marks represent Bragg reflections and the lower curves are the difference (solid line) plot.....</i>	<i>108</i>

<i>Figure 4.4: Raman Spectra recorded at RT for (a) Raman Spectra for Pure and Mn (2 and 3%) doped TiO₂ sample and (b) Raman Spectra for Pure and Co (5 and 10%) doped TiO₂ sample..</i>	109
<i>Figure 4.5: Absorption spectra of (a) Pure TiO₂ sample (b) 5% Co doped TiO₂ sample (c) 10% Co doped TiO₂ sample.....</i>	112
<i>Figure 4.6: Absorption spectra of Ti_{1-x}Co_xO₂ (x=0.00, 0.05, and 0.10).....</i>	113
<i>Figure 4.7: Absorption spectra of (a) Pure TiO₂ sample (b) 1% Mn doped TiO₂ sample (c) 2% Mn doped TiO₂ sample (d) 3% Mn doped TiO₂ sample.....</i>	115
<i>Figure 4.8: Absorption spectra of Ti_{1-x}Mn_xO₂ (x=0.00, 0.01, 0.02 and 0.03).....</i>	116
<i>Figure 4.9: Variation in the bandgap of (a) Co doped TiO₂ polycrystalline with Co concentration. (b) Mn doped TiO₂ with Mn concentration.....</i>	117
<i>Figure 4.10: Room temperature (300 K) hysteresis curves for the 10% Co doped TiO₂</i>	120
<i>Figure 5.1: (a-c): Fitted XRD patterns of pure and Co doped Zn_{1-x}Co_xO nano-crystalline samples. The observed (calculated) profiles are shown by open circles (solid line) curves. The short vertical marks represent Bragg reflections and the lower curves are the difference (solid line) plot.....</i>	132
<i>Figure 5.2: X-ray diffraction pattern of pure and Co doped ZnO nano-crystalline samples, in a limited range, showing the three major Bragg reflections</i>	134
<i>Figure 5.3: EDX spectrum of 10% Co doped ZnO</i>	135
<i>Figure 5.4(a-b): SEM micrographs of pure and Co doped Zn_{1-x}Co_xO nanocrystalline sample</i>	136
<i>Figure 5.5: Absorption spectra of (a) Pure ZnO nano-crystalline sample (b) 5% Co doped ZnO nano-crystalline (c) 10% Co doped ZnO nano-crystalline</i>	138
<i>Figure 5.6: (a) Absorption spectra of Zn_{1-x}Co_xO (x=0.00, 0.05, and 0.10), (b) Variation in the bandgap of Co doped ZnO nano-crystals with Co concentration.....</i>	140
<i>Figure 5.7: Hysteresis curves of Zn_{1-x}Co_xO (x=0.05 and 0.10) nano-crystals recorded at 300 K</i>	142
<i>Figure 5.8: ZFC and FC MT curves for 10 % Co doped ZnO recorded in an external magnetic field of 100 Oe.....</i>	143