LIST OF FIGURES

Figure 1.1	TiO_6 polyhedra with three polymorphs of TiO_2: (a) rutile, (b) anatase and (c) brookite. Ti is represented as green and O as red spheres.	8
Figure 1.2	Basic physical processes (from left to right) involved in the formation of nanoparticle from an implant vs. the ion dose with regard to surface sputtering under irradiation.	15
Figure 1.3	Magnetization as a function of applied magnetic field of the films P, A, B at 300 K. The insets (a) show the zoomed view of the M–H loops and (b) depicts the M–H plot of Si substrate.	19
Figure 1.4	Schematic diagram representing the basic principle of a photocatalyst.	23
Figure 2.1	Experimental scheme for synthesis of TiO_2 nanoparticles.	30
Figure 2.2	Experimental scheme for synthesis of Mn doped TiO_2 nanoparticles.	31
Figure 2.3	Electron beam evaporation unit used for the deposition of TiO_2 film.	32
Figure 2.4	The schematic diagram of e-beam evaporation arrangement depicting various parts.	32
Figure 2.5	Pictorial representation of the fabrication of TiO_2-cement composite pellets.	33
Figure 2.6	Experimental scheme for synthesis of TiO_2-Cement pellets.	34
Figure 2.7	The schematic diagram of cement and TiO_2 composite.	34
Figure 2.8	ECR ion source used for low energy ion beam irradiation (IUAC).	35
Figure 2.9	Schematic representation of incident and diffracted X-rays from the crystal lattice.	38
Figure 2.10	Scanning Probe Microscope used for the analysis of the sample.	43

Figure 2.11 Shimadzu 2600 UV-Visible Spectrophotometer. 45

Figure 2.12 Magnetic properties measurement system used for magnetic properties measurement. 47

Figure 2.13 Photocatalysis (a) under UV light and (b) under sunlight. 49

Figure 3.1 (a) XRD pattern of TiO_2 synthesised by sol-gel route post calcined at 500 ºC, (b) Raman spectrum of TiO_2. 56

Figure 3.2 (a) Field emission scanning electron micrograph of synthesised TiO_2 sample calcined at 500 ºC, (b) The corresponding particle size distribution histogram. 57

Figure 3.3 (a) TEM image of synthesised TiO_2 sample calcined at 500 ºC, (b) the corresponding particle size distribution histogram, (c) shows the HRTEM image (d) shows the typical SAED pattern of the sample. 57

Figure 3.4 (a) Absorbance spectrum of TiO_2 nanoparticles calcined at 500 ºC, with broad absorbance (b) The dependence of $(\alpha h\nu)^{1/2}$ on the incident photon energy ($h\nu$) for TiO_2. 59

Figure 3.5 Time dependant degradation of MB, CR and RhB solution with photocatalyst TiO_2, before and after UV-irradiation; UV-Visible absorption spectra of dye solutions (a) MB, (b) CR, (c) RhB and Pictorial representation of degrade dye solution with increasing irradiation time (from left to right) (d) MB, (e) CR, (f) RhB. 61

Figure 3.6 Time dependant degradation of MB, CR and RhB solution with photocatalyst TiO_2, before and after sunlight irradiation; UV-Visible absorption spectra of dye solutions (a) MB, (b) CR, (c) RhB and Pictorial representation of degrade dye solution with increasing irradiation time (from left to right) (d) MB, (e) CR, (f) RhB. 62

Figure 3.7 Degradation percentage; (a) under UV (b) under sunlight. 63

Figure 3.8 The chromophores in CR, MB and RhB are (a) Azo group, (b) Thiazine group and (c) Xanthene group respectively. 63

Figure 3.9 First-order exponential decay curve of MB, CR and RhB, (a) under UV- irradiation, (b) under sunlight irradiation. 68

Figure 3.10 Effect of TiO_2 on erythrocyte membrane integrity. RBC suspensions were exposed to TiO_2 for 3h followed by 68

centrifugation. Red color indicates positive hemolysis. 1. Represents negative control, 2. Represents positive control, 3. Represents TiO_2 sample.

Figure 3.11 Platelet aggregation induced by TiO_2. 1. Represents TiO_2 and 2. Represent thrombin. 71

Figure 3.12 (a) ROS generation in H_2DCF-DA loaded platelets treated TiO_2, H_2O_2 as positive control and NAC as negative control. Fluorescence was recorded at 530nm (excitation, 500nm). The results are representative of three independent experiments. (b) Histogram representation of ROS generation in, Control, TiO_2 and H_2O_2. 71

Figure 3.13 MTT assay of TiO_2. SDS indicates the controlled experiment. 72

Figure 3.14 HRSEM images of (a) cement, (b) and (c) cement and TiO_2 composites. 75

Figure 3.15 (a) UV-visible absorption spectra of MB, RhB and CR, dye solutions with pellet TC1 before and after irradiating with sunlight, (b) show the pictorial representation of dye solutions from 0 min to 120 min (left to right) and (c) Degradation percentage of dyes. 77

Figure 3.16 (a) UV-visible absorption spectra of MB, (b) RhB and (c) CR, dye solutions with pellet TC2 before and after irradiating with sunlight. Inset show the pictorial representation of dye solutions from 0 min to 240 min (left to right), (d) Degradation percentage of dyes. 78

Figure 3.17 (a) UV-visible absorption spectra of MB, RhB and CR, dye solutions with pellet TC3 before and after irradiating with sunlight. (b) show the pictorial representation of dye solutions from 0 min to 240 min (left to right), (c) Degradation percentage of dyes. 79

Figure 3.18 Schematic diagram for mechanism of photocatalysis using cement and TiO_2 pellets, (a) TC1 and (b) TC2 and TC3 under sunlight. 80

Figure 4.1 Le-Bail profile fitting of XRD patterns of $Ti_{1-x}Mn_xO_2$ (x = 0.01, 0.02 and 0.03) using the FULLPROF program. 87

Figure 4.2 Raman spectra of $Ti_{1-x}Mn_xO_2$ (x = 0.01, 0.02 and 0.03). 87

Figure 4.3 (a) Bright field TEM images of $Ti_{1-x}Mn_xO_2$ (i) x= 0.01 and (ii) x= 0.03; (b) show particle size distribution, (c) HRTEM images and zoomed view of lattice planes, (d) SAED pattern. 88

Figure 4.4 (a) N_2 adsorption and desorption isotherms of TMn1, (b) shows 89

pore size distribution curve.

Figure 4.5 XPS patterns of (a) O1s, (b) Ti 2p and (c) Mn 2p of $Ti_{1-x}Mn_xO_2$ (x=0.01 and 0.03). 91

Figure 4.6 (a) Temperature dependent magnetization under zero field cooling (ZFC) and field cooling (FC) at 50 Oe of $Ti_{1-x}Mn_xO_2$ (i) x = 0.01 and (ii) x = 0.03, (b) show corresponding temperature dependent inverse susceptibility. 92

Figure 4.7 (a) M vs H of $Ti_{1-x}Mn_xO_2$ (x =0.01 and 0.03) at 10 K, (b) zoomed view of M-H plot. 95

Figure 4.8 UV-visible absorption spectra of MB, RhB and CR solution before and after irradiation with sunlight using $Ti_{1-x}Mn_xO_2$ (a) x = 0.01 and (b) x = 0.03; (c) Degradation rate of MB, RhB and CR (i) x =0.01 and (ii) x = 0.03. 95-96

Figure 4.9 Degradation profile of MB using $Ti_{1-x}Mn_xO_2$ (a) x = 0.01 and (b) x = 0.03, under sunlight. 97

Figure 4.10 Antibacterial activity of Mn doped TiO_2 against S.Aureus. 99

Figure 5.1 Electronic and nuclear energy loss as a function of energy for argon ion on the TiO_2 target. 101

Figure 5.2 RBS spectra of TiO_2 thin films indicating Ti, Si and O edges. 103

Figure 5.3 (a) GAXRD pattern of TiO_2 thin films annealed in O_2 environment at 500 ºC before and after irradiation with 500 keV Ar^{2+} ions and (b) Raman spectra of TiO_2 thin films before and after irradiating with 500 keV Ar ion. 104

Figure 5.4 SPM image for topography of TiO_2 thin films A, B, F are (a), (b) and (c), respectively; (d), (e) and (f) depict the 3D representation of the respective films. 106

Figure 5.5 Roughness histograms of TiO_2 thin films before and after irradiating with 500 keV Ar ion. 107

Figure 5.6 SPM image of TiO_2 thin films with grain structure of films A and F are (a), (b) respectively; (c), (d) depict the 3D representation of the respective films and (e), (f) represents grain size distribution. 108

Figure 5.7 (a) Magnetization as a function of applied magnetic field of films A, B and F, are at 300 K, (b) show the zoomed view of the M–H loops. 111

Figure 5..8	XPS of TiO_2 films A, B and F (a) full survey scan (b) Oxygen 1s core level spectra having Gaussian fitting with Shirley background (c) Ti 2p core level spectra.	111-112
Figure 6.1	RBS spectra of TiO_2 thin films indicating Ti, Si and O edges.	116
Figure 6.2	GAXRD pattern of TiO_2 thin films annealed in O_2 environment at 900 ºC before and after irradiation with 500 keV Ar^{2+} ions.	118
Figure 6.3	Raman spectra of TiO_2 thin films annealed in O_2 environment at 900 ºC before and after irradiation with 500 keV Ar^{2+} ions.	118
Figure 6.4	AFM images of pristine and irradiated TiO_2 thin films A, B and C are (a), (b), (c) respectively. (d), (e) and (f) depict the 3D representation of the respective films.	121
Figure 6.5	Roughness histograms of TiO_2 thin films before and after irradiating with 500 keV Ar ion.	122
Figure 6.6	AFM image of TiO_2 thin films with grain structure of film A, B, C are (a), (b) and (c) respectively, (d)- (f) depict the 3D representation of the respective films and (g)- (i) show grain size distribution of respective films.	123-124
Figure 6.7	(a) Magnetization as a function of applied magnetic field of the films, A, B, C at 300 K, (b) show the zoomed view of the M–H loops.	125
Figure 6.8	(a) XPS of TiO_2 films A and C (a) Ti 2p core level spectra of the films A and C, (b) Oxygen 1s core level spectra of the films A and C.	127