

Summary

1- Introduction	18
1.1 Biomimetics.....	18
1.1.1 Biomineralization	19
1.1.2 Biomorphic materials	22
1.1.3 Use of biotemplates to obtain nanomaterials	25
1.1.4 Use of eggshell membranes as biotemplates	26
1.1.5 Synthesis of ZnO and TiO ₂ by biomimetization of eggshell membranes	27
1.1.6 The eggshell and its membranes.....	28
1.2 Zinc oxide (ZnO).....	30
1.2.1 ZnO synthesis methods	32
1.2.2 Preparation of ZnO nanoparticles by chemical routes...	32
1.2.3 Preparation of thin films of ZnO.....	35
1.2.4 ZnO Synthesis with the use of eggshell membranes as a biotemplate	38
1.3 Tlitanium Dioxide (TiO ₂)	43
1.3.1 TiO ₂ synthesis by solution routes	45
1.3.2 Synthesis of macroporous TiO ₂ networks	48
1.3.3 Biomimetic synthesis of TiO ₂	49
1.3.4 Synthesis of TiO ₂ using ESM as biotemplates	50
1.4 The functioning of the DSSC.....	52
1.4.1 Improvements in DSSC	53
1.4.2 The use of ZnO and TiO ₂ as electrodes in DSSC	59
1.4.3 Solar cell measurement parameters	62
2- Objectives.....	67
2.1 Objective of the thesis	68
3- Experimental Procedure.....	69
3.1 Materials	71
3.2 Methods	72
3.2.1 Synthesis of ZnO and TiO ₂	72
3.2.2 Preparation of the photovoltaic devices.....	74
3.3 Characterizations.....	76
3.3.1 Loss of mass and thermodiferencial analysis.....	76

3.3.2	X-ray Diffraction	76
3.3.3	Morphology	78
3.3.4	Optical properties.....	78
3.3.5	Surface area analysis.....	79
3.3.6	Chemical composition analysis	80
3.3.7	Photovoltaic characterizations.....	80
4-	Results and Discussion	81
4.1	Morphologic study of the eggshell.....	81
4.2	Morphological differences between TiO ₂ powders produced with different membranes	84
4.3	Decomposition of the in natura and hybrid membranes with titanium (effect of the firing atmosphere).....	86
4.4	Decomposition of hybrid membranes prepared with different sources of zinc	88
4.5	Effect of the thermal treatment temperature on the phase formation of biomimetic TiO ₂	89
4.6	Effect of the thermal treatment temperature on the phases formation for biomimetic and precipitated ZnO	92
4.7	Effect of thermal treatment temperature on the morphology of biomimetic oxides	96
4.8	Identification of contaminants of biomimetic ZnO	99
4.9	Optical properties of biomimetic TiO ₂ thermal treated in different temperatures	103
4.10	Optical properties of biomimetic ZnO thermal treated in different temperatures	105
4.11	Surface area and porosity of biomimetic TiO ₂	111
4.12	Characterization of biomimetic and commercial powders used for DSSC production	112
4.13	Characterization of the DSSC produced with biomimetic and commercial powders	118
5-	Conclusions	122
6-	References.....	125
7-	Future works	139