

TABLE OF CONTENTS

Summary.....	1
List of Abbreviations.....	11
Chapter 1 Introduction.....	13
Chapter 2 Supports.....	23
2.1 Introduction.....	23
2.2 Experimental.....	27
2.2.1 Materials.....	27
2.2.2 Preparation.....	27
2.2.3 Material Characterization.....	31
2.3 Results.....	33
2.3.1 Chemical Compositions of Supports.....	33
2.3.2 Microstructure of Supports.....	33
2.3.3 Acidity by NH ₃ - TPD.....	44
2.3.4 X-Ray Diffraction Measurements of Supports.....	47
2.3.5 Oxygen Storage Capacity Measurements of Supports.....	52
2.3.6 Thermogravimetry (DSC-TG) measurements of Supports.....	54
2.3.7 Fourier Transform Infra-Red (FTIR) Spectroscopy measurements of Supports.....	58
2.3.8 MBOH – Model reaction for chemical characteristic of Supports.....	59
2.4 Conclusions.....	71
References.....	73
Chapter 3 Supported Nickel Metal Based Catalyst.....	79
3.1 Preparation of Supported Nickel Catalyst.....	80
3.2 Chemical composition of catalysts.....	81
3.3 Microstructure of Supported Metal Catalysts.....	82
3.4 Acidity of Catalysts by NH ₃ -TPD.....	87
3.5 Reducibility of NiO in the Catalysts: Temperature programmed reduction (TPR).....	93
3.6 Dispersion of Nickel.....	105
3.7 XRD Phase and Crystallite size of the catalysts.....	112

3.8 HRTEM of Calcined Catalysts.....	116
3.9 HRTEM of Reduced & Stabilized Catalysts.....	123
3.10 Conclusions.....	127
References.....	129
Chapter 4 Ethanol Steam Reforming.....	133
4.1 Introduction.....	133
4.2 Experimental.....	135
4.3 Catalyst activity and co-relation with catalysts characteristics.....	136
4.4 Product Yields.....	148
4.5 Reaction Mechanism.....	151
4.6 Catalyst Stability: Screening runs.....	161
4.7 Catalyst Stability: Long Duration runs.....	171
4.8 Characteristics of Coke by HRTEM.....	182
4.9 Catalysts Regeneration.....	194
4.10 Conclusions.....	197
References.....	201
Chapter 5 Ethanol Dry Reforming.....	209
5.1 Introduction.....	209
5.2 Experimental.....	213
5.3 Catalyst Activity and co-relation with catalysts characterization.....	214
5.4 Reaction Mechanism.....	218
5.5 Byproducts.....	228
5.6 Catalyst Stability: Screening Studies.....	231
5.7 Long Duration (80 hours studies).....	237
5.8 Coke Morphology by HRTEM.....	240
5.9 Catalyst Regeneration.....	242
5.10 Conclusions.....	243
References.....	245
Chapter 6 Conclusions.....	249
6.1 Summary.....	249

6.2 Path Forward (Recommendation for Future work).....	253
List of Figures.....	257
List of Tables.....	265
Appendix.....	267
List of Articles Published/Conferences, Seminars attended.....	309