
List of Contents

Acknowledgement	viii
Table of Contents	ix
List of Tables	xiii
List of Figures	xiv
Preface	xviii
Chapter 1 Introduction – Applications of Porous Ceramics	1
1.1. Thermal Applications	2
1.2. Structural Applications	5
1.3. Chemical Applications	6
1.4. Filtration Applications	8
1.5. Electrical/Electronics Applications	9
1.6. Biomedical Applications	11
Chapter 2 Literature Review – Processing of Porous Ceramics	13
2.1. Partial Sintering	15
2.2. Solid state Bonding	16
2.2.1. Reaction bonding	16
2.2.2. Oxidation bonding	16
2.2.3. Bonding of fibrous precursor	17
2.3. Replication of 3-D Preforms	17
2.3.1. Slurry infiltration	18
2.3.2 Chemical vapor infiltration	21
2.4. Sacrificial Template Method	21
2.4.1 Synthetic and natural organic pore formers	22
2.4.2. Liquid pore formers	23
2.4.3. Salts, ceramics and metallic particles as pore former	23
2.5. Direct Foaming Method	23
2.5.1. Foam stabilization with surfactants	24
2.5.2. Stabilization with particles	25
2.6. Other Methods	26

2.6.1. Sol-gel method	26
2.6.2. Freeze drying	26
Chapter 3 Objectives	29
Chapter 4 Sucrose: An Alternate Binder in Dry Processing of Ceramics	32
4.1. Introduction	32
4.2. Experimental Procedure	33
4.2.1. Sample preparation	33
4.2.2. Sample characterization	35
4.3. Results	36
4.3.1. Density and strength of green compacts	36
4.3.2. Microstructure of green samples	38
4.3.3. Green machining	39
4.3.4. IR analysis of sucrose binders	40
4.3.5. Binder burnout characteristics of sucrose	41
4.3.6. Porosity of sintered compacts	42
4.4. Discussion	43
4.5. Summary	45
Chapter 5 Processing and Fabrication of Porous Ceramics with Tailored Pore Microstructure using Rice Husk and Sucrose	47
5.1. Introduction	47
5.2. Experimental Procedure	49
5.2.1. Processing and characterization of rice husk and sucrose	49
5.2.2. Composition formulation, shape forming and post processing	50
5.2.3. Physical characterization of green and sintered compacts	53
5.3. Results and Discussion	54
5.3.1. Analysis of properties of rice husk	54
5.3.2. Processing and fabrication	56
5.3.3. Heat treatment	58
5.3.4. Properties of green compacts	59
5.3.5. Physical properties of sintered compacts	61

5.3.6. Phase analysis	63
5.4. Fabrication of other Structures	65
5.5. Summary	65
Chapter 6 Microstructure and Mechanical Properties of Porous Alumina Fabricated using Rice Husk and Sucrose	67
6.1. Introduction	67
6.2. Sample Preparation and Characterization	67
6.2.1. Porosity and pore size distribution	67
6.2.2. Microstructure	68
6.2.3. Mechanical properties	68
6.3. Results and Discussion	69
6.3.1. Porosity and microstructure	69
6.3.2. Mechanical properties	76
6.4. Summary	82
Chapter 7 Thermal Properties of Porous Alumina Prepared using Rice Husk and Sucrose	83
7.1. Introduction	83
7.2. Sample Preparation and Characterization	84
7.3. Theory	84
7.3.1. Thermal conductivity	84
7.3.2. Thermal shock resistance	88
7.4. Results and Discussion	90
7.4.1. Thermal conductivity	90
7.4.2. Thermal shock resistance	97
7.5. Summary	100
Chapter 8 Electrical Properties of Porous Alumina Ceramics Fabricated using Rice Husk and Sucrose	102
8.1. Introduction	102
8.2. Sample Preparation and Characterization	104
8.3. Theory	105

8.3.1. Effect of porosity on dielectric constant (ϵ')	107
8.3.2. Effect of porosity on loss tangent ($\tan \delta$)	109
8.4. Results and Discussion	110
8.4.1. Dielectric constant	110
8.4.2. Loss tangent	117
8.5. Summary	126
Chapter 9 Gas Permeability Behavior of Porous Alumina Developed using Rice Husk and Sucrose	128
9.1. Introduction	128
9.2. Theory	130
9.3. Sample Preparation and Characterization	132
9.4. Results and Discussion	134
9.5. Summary	140
Chapter 10 Summary and Conclusions	142
References	144