

CONTENTS

	Page
PREFACE	i
CONTENT	iii
CHAPTER 1 INTRODUCTION	1
1.1 General remarks	2
1.2 Scope of this book	6
References and further readings	7
 CHAPTER 2 FUNDAMENTALS OF INTERACTIONS BETWEEN CEMENT-BASED MATERIALS AND MICROWAVES	 11
2.1 Materials	12
2.1.1 Portland cement	12
2.1.1 Physical and chemical properties	12
2.1.2 Chemistry of hydraulic Portland cement	14
2.1.3 The CaO-SiO ₂ -H ₂ O system	15
2.2 Microwaves	20
References and further readings	25
 CHAPTER 3 MICROWAVE AND CEMENT-BASED MATERIAL INTERACTIONS AT HIGH TEMPERATURE: SINTERING OF RICE HUSK ASH	 27
3.1 Introduction	29
3.2 Basic knowledge	33
3.2.1 Characteristic of RHA in Thailand	34
3.2.2 Development of RHA in cementitious material	
by using microwave energy	38
3.2.2.1 Starting materials	38
3.2.2.2 Microwave sintering setup	39

CONTENTS

	Page
3.2.2.3 Characteristics of the microwave System	41
3.3 Instrumentation	50
3.3.1 Phase identification by Powder X-ray Diffraction (XRD)	50
3.3.2 Morphology by Scanning Electron Microscope (SEM)	50
3.3.3 Heat evolution by the calorimetric method	51
3.3.4 Strength index of the pastes	52
3.3.5 Testing procedures	53
3.4 Results	54
3.4.1 Morphology	54
3.4.2 Phase compositions	56
3.4.3 Strength index	57
3.4.4 Heat evolution	57
3.5 Conclusion	58
References and further readings	59

CHAPTER 4 DIELECTRIC PROPERTIES OF CEMENT-BASED

MATERIALS	61
4.1 Fundamentals of microwave and cement-based materials interactions	62
4.2 Methodology	64
4.2.1 Starting materials	64
4.2.2 Mixture proportions	68
4.2.3 Testing procedures	69
4.3 Results	73

CHAPTER 5 ACCELERATED CURING OF CEMENTITIOUS

5.3.4.4 Thermal Analysis 115

CONTENTS

	Page
5.3.4.5 Axial and unconfined load	
compressive strength	116
5.4 Results and discussion	117
5.4.1 Effects of the mix proportions of cementitious	
Materials	117
5.4.1.1 Water-to-solid mass ratios (w/s)	117
5.4.1.2 Pozzolan materials	132
5.4.1.3 Mortar and concrete	145
5.4.2 Effects of microwave processing	154
5.4.2.1 Delay times	154
5.4.2.2 Microwave power on heating profile	
and properties	168
5.4.2.3 Sequential processes	177
5.4.3 Normal and low pressure within microwave	
cavity	186
5.4.4 Comparison to conventional curing method:	
a case study of the lime-saturated water and	
autoclave-curing methods	192
5.5 Concluding remarks	197
References and further readings	199

CHAPTER 6 THEORITICAL MODEL TO PREDICT THE	
PROPERTIES OF CEMENT-BASED MATERIALS WHEN	
SUBJECTED TO MICROWAVE ENERGY	203

CONTENTS

	Page
6.1 Relationship between the compressive strengths of paste, mortar and concrete when subjected to microwave energy and normal curing (using lime- saturated deionized water)	205
6.2 Relationship of thermal history and strength development: maturity analysis	220
6.3 Hydration modeling of cement paste during application of microwave energy	227
6.3.1 Background	227
6.3.2 Analysis of dielectric properties	231
6.3.3 Analysis of heating problem: conduction mode of heat transfer	232
6.3.3.1 Assumptions	233
6.3.3.2 Basic equations	234
6.3.3.3 Boundary conditions	234
6.3.3.4 Numerical solution program	235
6.3.3.5 Parameters used to calculate	241
6.3.3.6 Results and discussion	244
6.4 Concluding remarks	248
References and further readings	250
BIBLIOGRAPHY	255