DEVELOPMENT OF A HIGH THERMAL SHOCK RESISTANT CERAMIC BODY SUITABLE FOR COOKWARE

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters thesis under my supervision.

Signature of the supervisor: Date:

DEDICATION

I dedicate this work to my parents and family because of all the wonderful things they do for me and supporting me all the way.

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P.P.S.S. Pussepitiya
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ABSTRACT

Development of a ceramic based cookware body with adequate thermal shock resistance was successfully developed using low cost raw materials. The objective of this work was to determine the composition and thermal shock resistance of a ceramic body suitable for a direct flame cookware. To achieve this objective cookware body should have low thermal expansion coefficient, high strength, low water absorption and high thermal shock resistance. In this study ball clay, talc, alumina and zirconium silicate were used as starting raw materials and twenty five samples were investigated with different compositions. All samples were wet-mixed, shaped by slip casting, dried and fired to temperature 1250^0C in an electric furnace. Modulus of Rupture (MOR) was tested by the three point bending method; the thermal conductivity of each body was measured with Lee's disk method and the Coefficient of Thermal expansion (CTE) was measured by thermo mechanical analyzer. The thermal shock resistance of each sample was calculated with Kingery's formula.

Optimum thermal shock resistance of 74 $KJm^{-1}s^{-1}$was achieved for a body composition of 45% of clay, 15% of talc, 15% of alumina and 25% of zirconium silicate which was fired to 1250^0C. Further modulus of rupture and coefficients of thermal expansion of the ceramic body were 74 MPa and 30.2×10^{-7} $/^0$C respectively. These results suggest that the ceramic body is suitable to be used in cookware applications.

Key words: cookware, modulus of rupture, thermal shock resistance, coefficients of thermal expansion

TABLE OF CONTENT

Declaration			i
Acknowledgement			ii
Abstract			iii
Dedication			iv
Content			v
List of Figures and Tables			viii
List of terms, abbreviations and symbols			ix
1.	Introduction		1
	1.1	Background Research	1
	1.2	Objectives	3
	1.5	Structure of the thesis	4
2.	Literature Review		5
	2.1	Ceramic article	5
	2.2	Cookware Materials	5
	2.3	Ceramic Cookware	8
	2.4	Properties of cookware	9
	2.5	Thermal Properties of Cookware	9
		2.5.1 Specific Heat Capacity	9
		2.5.2 Thermal Expansion	10
		2.5.3 Thermal Conductivity	10
		2.5.4 Thermal Shock Resistance	11
	2.6	Ceramic fabrication techniques	13
		2.6.1 Slip casting	14
		2.6.2 Moulding	14
		2.6.3 Drying	15
		2.6.4 Firing	15
		2.6.5 Characteristics of casting slip	15

3. Research Methodology 17
3.1 Selection of Raw Materials 17
3.2 Fabrication procedure of test sample 17
3.3 Slip preparation 18
3.3.1 Moisture content of the raw materials 18
3.3.2 Density of the slip 19
3.3.3 Fluidity and thixotropy of the slip 19
3.3.4 Particle size distribution 19
3.4 Sample preparation 20
3.5 Laboratory test during fabrication 20
3.5.1 Wet to dry and dry to fired shrinkage 20
3.5.2 Green Strength and Fired Strength 21
3.5.3 Thermal conductivity measurements 21
3.5.4 Modulus of elasticity measurements 23
3.5.5 Thermal shock resistance calculations 24
3.5.6 Thermal shock resistance of the product 24
3.5.7 Direct heating test on gas cooker 25

4. Results and Discussion 26
4.1 Results 26
4.2 Properties of the casting slip 28
4.3 Properties of body composition 28
4.4 Thermal shock resistance of body 29
4.5 Gross firing cycle in electric furnace 30
4.6 Fabricated products 31
4.7 Thermal shock resistance of the products 31
4.8 Direct heating test on the gas cooker 32
4.9 Calculation of trial production cost 33

5. Conclusion and Suggestions for future work 34

5.1 Conclusions 34

5.2 Recommendations 34

References List 35

Appendices 37

Appendix A: Drawings of the cookware 37

Appendix B: Trial production cost of the cookware 38

Appendix C: Technical data sheets of the raw materials 39

LIST OF FIGURES

		Page
Figure 3.1	Fabrication procedure of test sample	18
Figure 3.1	Three point bending tester	21
Figure 3.2	Test sample of thermal conductivity measurement	21
Figure 3.3	Lee's disk apparatus	22
Figure 3.4	Direct heating test on gas cooker	25
Figure 4.1	Particle size distributions of casting slip	28
Figure 4.2	Firing cycle on electric furnace	30
Figure 4.3	Fabricated cookware samples (small)	31
Figure 5.4	Actual size cookware samples	31
Figure 4.5	Direct heating test on gas cooker	33

LIST OF TABLES

		Page
Table 2.1	Advantages and disadvantages of cookware	7
Table 2.2	Importance of various properties of white ware products	12
Table 3.1	The composition of raw materials used for prepared body	20
Table 4.1	Modulus of rupture (MOR) values of ceramic bodies fired to 1250^0C	27
Table 4.2	Coefficient of thermal expansion of ceramic bodies fired to 1250^0C	27
Table 4.3	Experiment results of the thermal shock resistance of the ceramic bodies	29
Table 4.4	Thermal and Mechanical properties of most suitable body for cookware	29
Table 4.5	Shrinkage of the most suitable ceramic body composition	30
Table 4.6	Results of thermal shock resistance of final product	32

LIST OF TERMS, ABBREVIATIONS AND SYMBOLS

Abbreviation	Description
ρ	Modulus of rupture
α	Coefficient of thermal expansion
υ	Poison's ratio
b	Width of the specimen
C_p	Heat capacity
d	Thickness of the specimen
DTA	Differential Thermal Analysis
E	Modulus of elasticity
F	Applied force
K	Thermal conductivity
l	Span length
m	Mass of the sample
T	Temperature
ΔQ	Amount of heat
ΔT	Temperature different