

WOOD PULP MICROFIBERS IN CEMENT-BASED COMPOSITES:
IMPROVING FIBER DISTRIBUTION AND CHARACTERIZING
COMPOSITE BEHAVIOR

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The Academic Faculty

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WOOD PULP MICROFIBERS IN CEMENT-BASED COMPOSITES:
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DEDICATION

To my parents

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TABLE OF CONTENT

Dedication	iii
Acknowledgement	iv
Summary	vi
Table of Content	vii
List of Tables	xi
List of Figures	xii
Chapter I - Introduction	1
References	8
Chapter II - Critical Review: Use of Pulp Fibers in Cement-based Materials	10
2.1 Fiber reinforced cement-based composites	10
2.2 Wood Pulp Microfibers	11
2.2.1 Introduction	11
2.2.2 Wood structure	14
2.2.2.1 The structure of softwoods	15
2.2.2.2 The structure of hardwoods	17
2.2.3 Ultra-structure and chemistry of wood pulp microfibers	18
2.2.4 Pulping	21
2.2.4.1 Mechanical pulping	22
2.2.4.2 Chemical pulping	22
2.2.4.3 Semichemical pulping	23
2.2.5 Bleaching	24
2.3 Reinforcement of cement-based composites with wood pulp microfibers	24
2.3.1 Production methods and techniques	26
2.3.2 Properties of wood pulp fiber cement-based composites	28
2.3.2.1 Effect of fiber volume fraction	28
2.3.2.2 Effect of Curing	29
2.3.2.3 Effect of matrix composition	29
2.3.2.4 Effect of wood fiber type and processing method	30
2.3.2.5 Effect of fiber treatment	33
2.3.2.6 Effect of moisture state	35
2.3.2.7 Volumetric changes and plastic and drying shrinkage cracking	36
2.3.3 Microstructure and role of fiber matrix interface	37
2.3.4 Durability, weathering and long term performance	38
References	55

Chapter III - Experimental Details	60
3.1 Overview of Research Plan	60
3.2 Materials	60
3.3 Mix Design	62
3.4 Mixing Methods	70
3.5 Compression and flexure testing	75
3.5.1 Sample preparation	75
3.5.2 Test equipment and methods	76
3.6 Shrinkage testing	76
3.6.1 Sample preparation	76
3.6.2 Test methods and equipment	78
References	89
Chapter IV - Microfiber Treatment and Distribution	91
4.1 Introduction	91
4.2 Statement of research needs	92
4.3 Treatment Methodology	94
4.3.1 Mechanical treatment	94
4.3.2 Chemical treatment	96
4.4 Optimization of fiber processing method	98
4.4.1 Ash content	99
4.4.2 Microscopy	100
References	110
Chapter V - Fresh Properties and Compressive Characteristics of Pulp Fiber Reinforced Mortar and Concrete	112
5.1 Introduction	112
5.2 Fresh properties	113
5.2.1 Effect of microfiber volume fraction on flow	113
5.2.2 Effect of treatment on flow	114
5.3 Compressive characteristics	115
5.3.1 Effect of microfiber volume fraction on mortar compressive strength	115
5.3.2 Effect of microfiber treatment on mortar compressive strength	117
5.3.3 Effect of age on WPM- reinforced mortar compressive strength	118
5.3.4 Effect of testing condition on mortar compressive strength	120
5.3.5 Effect of pulp fiber reinforcement on properties of concrete in compression.	122
References	141
Chapter VI - Review for the Methods Used to Measure and Evaluate Flexural Toughness of Fiber Reinforced Cement-Based Composites	142
6.1 Introduction	142
6.2 Methods for testing flexural toughness of cement-based composites	144
6.3 Important test parameters	146
6.3.1 Specimen size and geometry	146

6.3.2	Specimen manufacture method	147
6.3.3	Specimen configuration	147
6.3.4	Testing systems	148
6.3.5	Loading configurations	149
6.3.6	Measuring techniques	150
6.4	Characterization of cement-based composites flexural toughness	155
6.4.1	Energy-based methods	155
6.4.2	Strength-based methods	159
6.4.3	Deflection-based methods	164
6.5	Concerns about methods for flexural toughness characterization	164
6.5.1	Measurement and definition of first crack deflection	164
6.5.2	Loading configuration and specimen size	167
6.5.3	Instability after matrix cracking	169
	References	180

Chapter VII - A New Simple and Practical Method to Characterize the Toughness Based on Flexural Load-Deflection Response of Fiber Reinforced Cement-Based Composites

		184
7.1	Need for new method	184
7.2	Scope	187
7.3	Principals of the proposed method	188
7.4	Description of the proposed method	190
7.4.1	Identifying the first crack point on the load-deflection curve	190
7.4.2	Modeling unreinforced cement-based composite flexural behavior	193
7.4.3	Introducing dimensionless toughness indices	195
7.5	Special cases	199
7.5.1	Instability after matrix cracking	200
7.5.2	Deflection measured by crosshead movement	203
7.6	Calculations	205
7.7	Examples and verification	206
7.7.1	Simple example	207
7.7.2	Effect of different deflection measuring techniques	208
7.7.3	Effect of instability after matrix cracking	211
7.7.4	Sensitivity of the proposed indices to different fiber parameters	212
7.8	Advantages and disadvantages of the new method	215
7.9	Further research	216
	References	235

Chapter VIII - Flexural Behavior of Wood Pulp Microfiber Cement-Based Composites

		237
8.1.	Effect of fiber volume fraction	238
8.2.	Effect of different fiber treatment	244
8.2.1.	Effect of fibrillation	245
8.2.2.	Effect of type of siliceous particles	246
8.2.3.	Effect of amount of siliceous particles	248

8.2.4.	Summary of effect of treatment	252
8.3.	Effect of fiber length	253
8.4.	Effect of mixing softwood and hardwood microfibers	256
8.5.	Effect of age	257
8.6.	Effect of wet and dry testing conditions	263
	References	317
Chapter IX - Shrinkage Properties of Wood Pulp Microfiber Cement-Based Composites		319
9.1	Introduction	319
9.2	Effect of wood pulp microfibers on unit weight	320
9.3	Effect of fiber volume fraction on free shrinkage	322
9.4	Effect of fiber treatment on free shrinkage	323
9.5	Effect of fiber length on free shrinkage	325
9.6	Restrained shrinkage	325
	References	336
Chapter IX - Summary, Conclusions, and Future Research		337
10.1	Summary	337
10.2	Conclusions	339
10.3	Recommendations for further research	343

LIST OF TABLES

Table (1-1)	Some typical properties of Douglas Fir fibers and other fibers and microfibers.	7
Table (2-1)	Typical properties of different common used natural fibers [ACI 544,1R-96]	43
Table (2-2)	Major types of cells in softwood [Kocurek and Stevens, 1983]	44
Table (2-3)	Major types of cells in hardwood [Kocurek and Stevens, 1983]	44
Table (2-4)	General Classification of pulping processes [Smook, 1982]	45
Table (3-1)	Chemical analysis of the used cement	80
Table (3-2)	The composite constituents according to mix design I	81
Table (3-3)	The composite constituents according to mix design II	81
Table (5-1)	Flow data for pulp fiber reinforced mortar	126
Table (5-2)	Average compressive strength for different fiber volume fractions and different softwood fiber treatment	127
Table (5-3)	Effect of testing condition on the average compressive strength of pulp fiber reinforced mortar	128
Table (5-4)	Properties for - pulp fiber reinforced concrete tested in compression at 7 and 28 days.	129
Table (7-1)	Method of calculation the post-cracking toughness indices using three different load-deflection curves. From [Banthia and Trottier, 1995]	217
Table (7-2)	Calculation of post-cracking toughness indices for different load-deflection curves	218
Table (7-3)	Post-cracking toughness indices for different load-deflection curves and other corresponding toughness indices. From [Johnston 1995]	219
Table (7-4)	Post-cracking toughness indices for different load-deflection curves and the other corresponding toughness indices for different open loop and closed loop testing systems.	220
Table (7-5)	Post-cracking toughness indices and other toughness indices for different cement based mixes. From [Chen <i>et al.</i> , 1995]	221
Table (8-1)	Flexure strength and standard deviation for wood pulp microfiber reinforced mortar samples using different fiber volume fraction,	

	different treatment types and levels and different lengths at 7 and 28 days	268
Table (8-2)	Post cracking flexure toughness parameters for wood pulp microfiber reinforced mortar samples using different fiber volume fraction, different treatment types and levels and different lengths at 7 and 28 days	270
Table (8-3)	Flexure strength and standard deviation for wood pulp microfiber reinforced mortar samples showing the effect of age up to 12 weeks	272
Table (8-4)	Post cracking flexure toughness parameters for wood pulp microfiber reinforced mortar samples showing the effect of age up to 12 weeks	272
Table (8-5)	Flexure strength and standard deviation for wood pulp microfiber reinforced mortar samples showing the effect of moisture state at testing.	273
Table (8-6)	Post cracking flexure toughness parameters for wood pulp microfiber reinforced mortar samples showing the effect of moisture state at testing.	274

LIST OF FIGURES

Figure (2-1)	Two diagrams showing the three major structural planes of wood - (R) radial - (T) tangential - (X) transverse [Kocurek and Stevens, 1983]	46
Figure (2-2)	Cross section sketch of a mature stem, showing outer bark, inner bark, sapwood and heartwood [Smook G. A. 1982]	46
Figure (2-3)	A wood block sketch illustrating the structural features of softwood [Smook G. A. 1982]	47
Figure (2-4)	A wood block sketch illustrating the structural features of a hardwood [Smook G. A. 1982]	47
Figure (2-5)	Diagramed major cell types in softwoods and hardwoods. All diagrams are at the same magnification to show the relative sizes of these elements [Kocurek and Stevens, 1983]	48
Figure (2-6)	The chemical components of wood [Smook, 1982]	49
Figure (2-7)	Cellulose Structure [Smook, 1982]	49
Figure (2-8)	Diagrammatic Representation of cellulose in the wood fiber wall [Kocurek and Stevens, 1983]	50
Figure (2-9)	Wall structure of softwood tracheid [Rance, 1980]	51
Figure (2-10)	Commercial manufacturing for fiber-cement products A. Reticem process - B. Pultrusion process [Shao et al., 1995]	51
Figure (2-11)	Schematic description of the Hatschek process [Bentur and Mindess, 1990]	52
Figure (2-12)	Effect of fiber mass fraction on the flexural strength (A) and toughness (B) [Coutts, 1987b]	52
Figure (2-13)	Effect of fiber type on the flexural strength (A) and toughness (B) [Coutts, 1987c]	53
Figure (2-14)	Effect of various testing conditions on the flexural strength (A) and toughness (B) [Coutts, 1984]	54
Figure (3-1)	Flow chart for the study program	82
Figure (3-2)	Hobart mixer used in mixing the Mortar samples	83
Figure (3-3)	Different mixing tools	83
Figure (3-4)	Compression Testing Machine	84
Figure (3-5)	Flexural test setup	84
Figure (3-6)	Arrangement and dimensions for the free shrinkage molds [ASTM C490]	85
Figure (3-7)	Ring test setup used in measuring the restrained shrinkage cracking	86
Figure (3-8)	Graph showing the detailed dimensions for the restrained shrinkage test setup (the ring test)	87
Figure (3-9)	Length change apparatus used for measuring free shrinkage	88

Figure (4-1)	Sketch for water Molecules Showing Hydrogen bond [Clark, 1985]	103
Figure (4-2)	Sketch illustrating different levels of hydrogen bonding [Smook, 1982]	103
Figure (4-3)	Sketch showing the used beater [Clark, 1985]	103
Figure (4-4)	Diagram of the cell wall structure [Clark, 1985]	103
Figure (4-5)	SEM images for unbeaten and beaten softwood fibers [Clark, 1985]	104
Figure (4-6)	Canadian Standard Freeness Tester [Clark, 1985]	104
Figure (4-7)	Sketch showing the chemical treatment mechanism.	105
Figure (4-8)	Effect of cationic starch on the amount of silica particles attached to the fiber surface	105
Figure (4-9)	SEM image for WPM beaten and treated with fly ash	106
Figure (4-10)	SEM image showing a closer view of WPM beaten and treated with fly ash	106
Figure (4-11)	SEM for WPM beaten and treated with silica fume	107
Figure (4-12)	SEM image for samples with untreated softwood pulp fiber; $V_f=1.7\%$	108
Figure (4-13)	CLSM image for samples with untreated softwood pulp fiber; $V_f=0.75\%$	108
Figure (4-14)	SEM image for samples with treated softwood pulp fiber; $V_f=1.2\%$	109
Figure (4-15)	SEM image for samples with treated hardwood pulp fiber; $V_f=2\%$	109
Figure (5-1)	Effect of volume fraction on the workability (flow %) of fiber reinforced mortar for different fiber treatments	130
Figure (5-2)	Effect of treatment on the workability of fiber reinforced mortar measured as flow (%)	130
Figure (5-3)	Effect of fiber volume fraction on the compressive strength of fiber reinforced mortar (fly ash content = 40%)	131
Figure (5-4)	Effect of fiber volume fraction on the compressive strength of fiber reinforced mortar (fly ash content = 50%)	131
Figure (5-5)	Fiber reinforced mortar compressive sample tested to a large deformation (left) compared to untested sample (right).	132
Figure (5-6)	Effect of treatment methods on the fiber reinforced mortar compressive strength (fiber volume fraction 0.6 %)	132
Figure (5-7)	Effect of treatment methods on the fiber reinforced mortar compressive strength (fiber volume fraction = 1.2 %)	133
Figure (5-8)	Effect of treatment method on the fiber reinforced mortar compressive strength (fiber volume fraction = 2 %)	133
Figure (5-9)	Effect of age on the compressive strength of fiber reinforced mortar	134

Figure (5-10)	Effect of testing condition on the compressive strength of fiber reinforced mortar at 7 days age	135
Figure (5-11)	Effect of testing condition on the compressive strength of fiber reinforced mortar at 28 days age	135
Figure (5-12)	The set up used to capture the stress-strain curves in compression.	136
Figure (5-13)	Effect of fiber volume fraction on the compressive strength of the fiber reinforced concrete at 7 and 28 days age	136
Figure (5-14)	Effect of fiber volume fraction on the modulus of elasticity in compression for fiber reinforced concrete at 7 and 28 days age	137
Figure (5-15)	Effect of fiber volume fraction on the toughness in compression for fiber reinforced concrete at 7 and 28 days age	137
Figure (5-16)	The WPM arresting concrete cylinder crack	138
Figure (5-17)	Stress-Strain behavior for of fiber reinforced concrete at 7 days age	139
Figure (5-18)	Stress-strain behavior for fiber reinforced at 28 days age	140
Figure (6-1)	Representation of different methods used in Evaluation flexural toughness	170
Figure (6-2)	Different load-deflection curves captured by different loading systems [Chen L. et al. 1995]	171
Figure (6-3)	A photo showing the loading and measuring setup for capturing the load-deflection response of fiber reinforced concrete while measuring the net deflection. [Johnston, 1995]	171
Figure (6-4)	Different deflection measuring systems for capturing the net deflection A. Japanese Yoke B. Top LVDT's C. Side LVDT [Chen <i>et al.</i> 1995]	172
Figure (6-5)	Differences in the load-deflection curve due testing in different laboratories using different testing equipment [Chen <i>et al.</i> 1995]	173
Figure (6-6)	Effect of different measurement system on capturing the load-deflection response [Banthia and Trottier, 1995-1]	173
Figure (6-7)	Loading System to introduce a stable crack in fiber reinforced concrete specimen [ASTM C1399]	174
Figure (6-8)	Comparison of closed-loop and residual strength test method curves for concrete with 0.5% of fibrillated polypropylene fiber (Banthia and Duby, 1999)	174
Figure (6-9)	Toughness indexes from flexural load-deflection diagram [ACI 544]	175
Figure (6-10)	Definition of Barr's toughness index [Barr and Hasso, 1985]	175
Figure (6-11)	Definition of Wang's toughness index [Wang and Baker, 1982]	176
Figure (6-12)	Toughness measures in German recommendations for evaluating flexural toughness of fiber reinforced concrete [Gopalaratnam and Gettu, 1995]	176
Figure (6-13)	Banthia proposed technique for evaluating flexural toughness of fiber reinforced concrete [Banthia and Trottier, 1995-1]	177

Figure (6-14)	Load-deflection curves for the same beam but including and excluding extraneous deflection [Banthia and Trottier, 1995-1]	177
Figure (6-15)	Initial ascending part of a Load-deflection curve [Banthia and Trottier, 1995-1]	178
Figure (6-16)	Differences between the third point loading test and center point loading test	178
Figure (6-17)	Comparative open-loop and closed loop testing of fiber reinforced concrete [Banthia and Dubey, 2000]	179
Figure (6-18)	Stable and unstable failure in the fiber reinforced concrete [Banthia and Trottier, 1995-1]	179
Figure (7-1)	Two different flexural behaviors for FRCCBC; for example: sample 1 can represents a composite reinforced with long fibers but with low fiber volume fraction, and sample 2 can represent a composite with shorter fibers and higher fiber volume fraction.	223
Figure (7-2)	Different flexural behavior for fiber reinforced cement-based composites - Responses 1, 2 and 3 show load drop while 4 shows no load drop	223
Figure (7-3)	Defining the first crack point on the load-deflection curve of the FRCBC	224
Figure (7-4)	Modeling unreinforced matrix	224
Figure (7-5)	The proposed parameters to describe the load-deflection curve	225
Figure (7-6)	Removing the unstable part after the load drop in different cases	226
Figure (7-7)	A graph showing the extraneous deformations in the flexural testing	227
Figure (7-8)	(A) A sketch for flexural load-deflection curve for FRCBC with the deflection measured using three different methods - (B) A sketch for flexural load-deflection curve for FRCBC with the deflection measured using three different methods but with the peak load location coincided at the same point.	228
Figure (7-9)	Load-deflection curves for plain and steel fiber reinforced concrete beams [Banthia and Trottier, 1995]	229
Figure (7-10)	Effect of extraneous deformation on load-deflection curves [Chen <i>et al.</i> , 1995]	229
Figure (7-11)	Load-deflection plots for hooked-end steel fiber reinforced concrete beam (fiber volume fraction = 0.5%) showing the influence of different methods of deflection measurement. [El-Shakra and Gopalaratnam, 1993].	230
Figure (7-12)	Load-deflection plots for a large unnotched polypropylene fiber reinforced beam (Type C - fiber volume fraction = 0.1%) showing the influence of different methods of deflection measurement. [Gopalaratnam <i>et al.</i> , 1991]	230
Figure (7-13)	Post-cracking toughness indices calculated from three load-deflection curves measured for the same specimen but using different deflection measuring techniques as Figure (6-6) by Banthia and Trottier [1995]	231

Figure (7-14)	Post-cracking toughness indices for the load-deflection curves in Figure (7-10) captured by Chen <i>et al.</i> [1995]	231
Figure (7-15)	Calculated post-cracking toughness indices for the load-deflection curves (A) Captured by El-shakra and Gopalaratnam [1993] in Figure (6-14) (B) Captured by El-shakra and Gopalaratnam [1993] in Figure (7-11) (C) Captured by Gopalaratnam <i>et al.</i> [1991] in Figure (7-12)	232
Figure (7-16)	Comparison of (a) ASTM C1018 I20 values, and (b) Japanese toughness values for: 0.25% steel fiber reinforced concrete mix (Mix 2) and 0.2 % polypropylene fiber reinforced concrete mix (Mix 5) [Chen <i>et al.</i> , 1995]	233
Figure (7-17)	Calculated post-cracking toughness for Mix 2 and Mix 5. Study by [Chen <i>et al.</i> , 1995]. (A) for N_R - (B) for N_S .	234
Figure (8-1)	Flexural strength and toughness parameter N_S for different fiber volume fractions (Fly ash content 40 %)	275
Figure (8-2)	Toughness parameter N_r for different fiber volume fractions (Fly ash content 40 %) - 7 days	276
Figure (8-3)	Toughness parameter N_r for different fiber volume fractions (fly ash content 40%) - 28 days	276
Figure (8-4)	Flexural load-deflection curves for different fiber volume fractions ($V_f=0.6, 1.2, 2.0$ %) at 7 & 28 Days (fly ash content = 40 %)	277
Figure (8-5)	Flexural strength and toughness parameter N_S for different fiber volume fractions (fly ash content 50 %)	278
Figure (8-6)	Toughness parameter N_r for different fiber volume fractions (fly ash content 50 %) - 7 days	279
Figure (8-7)	Toughness parameter N_r for different fiber volume fractions (fly ash content 50 %) - 28 days	279
Figure (8-8)	Flexural Load-Deflection Curves For different fiber volume fraction ($V_f=0.6, 1.2, 2.0$ %) at 7 & 28 Days (fly Ash content = 50 %)	280
Figure (8-9)	Flexural strength and toughness parameter N_S for different fiber volume fractions (fly ash content 68 %)	281
Figure (8-10)	Toughness parameter N_r for different fiber volume fractions (fly ash content 68 %) - 7 days	281
Figure (8-11)	Flexural load-deflection curves for different fiber volume fraction ($V_f=0.6, 1.2, 2.0$ %) at 7 days (fly Ash content = 68 %)	282
Figure (8-12)	Effect of WPM beating process on the flexural strength	283
Figure (8-13)	Effect of beating process on the toughness parameter N_S for different fiber volume fractions	283
Figure (8-14)	Toughness parameter N_r for beaten and unbeaten SWPMCBC with 0.6% fiber volume fraction.	284

Figure (8-15)	Toughness parameter N_r for beaten and unbeaten SWPMCBC with 1.2% fiber volume fraction.	284
Figure (8-16)	Toughness parameter N_r for beaten and unbeaten SWPMCBC with 2 % fiber volume fraction.	285
Figure (8-17)	Effect of fiber beating on the flexural behavior of the WPMCBC	286
Figure (8-18)	Effect of the type of fly ash used in treatment on the flexural strength	287
Figure (8-19)	Effect of the type of fly ash used in treatment on the flexural toughness parameter N_S	287
Figure (8-20)	Effect of the type of fly ash used in treatment on the flexural toughness parameters N_R (7days - $V_f = 1.2\%$)	288
Figure (8-21):	Effect of the type of fly ash used in treatment on the flexural toughness parameters N_R (7days - $V_f = 2\%$)	288
Figure (8-22)	Effect of fiber treatment on the flexural strength at 7 & 28 days and optimization of the fiber treatment ($V_f=0.6\%$)	289
Figure (8-23)	Effect of fiber treatment on the flexural strength at 7 & 28 days and optimization of the fiber treatment ($V_f=1.2\%$)	289
Figure (8-24)	Effect of fiber treatment on the flexural strength at 7 & 28 days and optimization of the fiber treatment ($V_f=2\%$)	290
Figure (8-25)	Effect of fiber treatment on the overall post-cracking flexural toughness parameter N_S at 7 & 28 days ($V_f=0.6\%$)	290
Figure (8-26)	Effect of fiber treatment on the overall post-cracking flexural toughness parameter N_S at 7 & 28 days ($V_f=1.2\%$)	291
Figure (8-27)	Effect of fiber treatment on the overall post-cracking flexural toughness parameter N_S at 7 & 28 days ($V_f=2\%$)	291
Figure (8-28)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 7 days ($V_f=0.6\%$)	292
Figure (8-29)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 7 days ($V_f=1.2\%$)	292
Figure (8-30)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 7 days ($V_f= 2\%$)	293
Figure (8-31)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 28 days ($V_f=0.6\%$)	293
Figure (8-32)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 28 days ($V_f=1.2\%$)	294
Figure (8-33)	Effect of fiber treatment on the post-cracking flexural toughness parameters N_R at 28 days ($V_f= 2\%$)	294
Figure (8-34)	SEM micrographs for fracture surfaces for mortar specimens reinforced with treated WPM	295
Figure (8-35)	Effect of fiber Length on the flexural strength of WPMCBC at 7days	296
Figure (8-36)	Effect of fiber length on the overall post-cracking flexural toughness parameter at 7 days	296
Figure (8-37)	Effect of fiber length on the post-cracking flexural toughness parameters N_R at 7days ($V_f=1.2\%$)	297

Figure (8-38)	Effect of fiber length on the post-cracking flexural toughness parameters N_R at 7days ($V_f = 2\%$)	297
Figure (8-39)	Effect of fiber length on the flexural load-deflection behavior of WPMCBC at 7 days ($V_f=1.2\%$)	298
Figure (8-40)	Effect of fiber length on the flexural load-deflection behavior of WPMCBC at 7 days ($V_f = 2\%$)	298
Figure (8-41)	Flexural strength and post-cracking flexural toughness parameter N_S for WPMCBC reinforced with SWPM and HWPM ($V_f=1.2\%$)	299
Figure (8-42)	Post-cracking flexural toughness parameter N_R for WPMCBC reinforced with SWPM and HWPM ($V_f=1.2\%$)	299
Figure (8-43)	Flexural load-deflection behavior of WPMCBC reinforced with mix of SWPM and HWPM ($V_f=1.2\%$)	300
Figure (8-44)	Effect of age on the flexural strength of WPMCBC	301
Figure (8-45)	Effect of age on the overall post-cracking toughness parameter N_S for WPMCBC	301
Figure (8-46)	Effect of the age on the post-cracking flexural toughness parameters ($V_f=1.2\%$)	302
Figure (8-47)	Effect of the age on the post-cracking flexural toughness parameters ($V_f=2\%$)	302
Figure (8-48)	Load-deflection curves for WPMCBC samples tested at different ages ($V_f=2\%$)	303
Figure (8-49)	SEM micrographs for the fracture surface of the WPMCBC tested in flexure at 7 days showing the fiber surface and the fiber pull out	304
Figure (8-50)	Different mode of wood pulp microfibers failure for samples tested at 12 weeks age	305
Figure (8-51)	SEM micrographs for the fracture surface of the WPMCBC tested in flexure at 12 weeks showing the mineralization inside the fiber lumen and on the fiber surface	306
Figure (8-52)	SEM micrographs for the fracture surface of the WPMCBC tested in flexure at 28 days showing the different fiber failure mode and the fiber surface	307
Figure (8-53)	Development of cement composite reinforced with WPM impact energy absorption [Campbell and Coutts, 1980]	308
Figure (8-54)	Effect of wet and dry testing condition on the flexural strength of WPMCBC- $V_f=1.2\%$	309
Figure (8-55)	Effect of wet and dry testing condition on the flexural strength of WPMCBC- $V_f=2\%$	309
Figure (8-56)	Effect of wet and dry testing condition on the flexural toughness parameter N_S of WPMCBC- $V_f=1.2\%$	310
Figure (8-57)	Effect of wet and dry testing condition on the flexural toughness parameter N_S of WPMCBC- $V_f=2\%$	310
Figure (8-58)	Effect of wet and dry testing condition on the flexural toughness parameter N_R of WPMCBC- 7 days- $V_f=1.2\%$	311

Figure (8-59)	Effect of wet and dry testing condition on the flexural toughness parameter N_R of WPMCBC - 7 days - $V_f=2\%$	311
Figure (8-60)	Effect of wet and dry testing condition on the flexural toughness parameter N_R of WPMCBC- 28 days- $V_f=1.2\%$	312
Figure (8-61)	Effect of wet and dry testing condition on the flexural toughness parameter N_R of WPMCBC - 28 days - $V_f=2\%$	312
Figure (8-62)	Flexural load-deflection curves for $V_f = 1.2\%$ at 28 Days for oven dry, wet & air dry testing conditions	313
Figure (8-63)	Flexural load-deflection curves for $V_f = 2\%$ at 28 Days for oven dry, wet & air dry samples	314
Figure (8-64)	SEM micrographs for the fracture surface of the WPMCBC tested oven dried in flexure at 7 days showing fiber failure mode	315
Figure (8-65)	SEM micrographs for the fracture surface of the WPMCBC tested oven dried in flexure at 7 days showing fiber failure mode and the separation between S1 and S2 layers	316
Figure (9-1)	Effect of WPM volume fraction on the unit weight of the WPM cement-based mortar	328
Figure (9-2)	Unit weight of unreinforced mortar and WPM mortar with treated (T) and untreated (UB-UT) WPM ($V_f=0.25\%$)	329
Figure (9-3)	Unit weight of unreinforced mortar and WPM mortar with treated (T) and untreated (UB-UT) WPM ($V_f=0.5\%$)	329
Figure (9-4)	Unit weight of unreinforced mortar and WPM mortar with treated (T) and untreated (UB-UT) WPM ($V_f=1\%$)	330
Figure (9-5)	Sample of the mortar prism samples used in measuring the free shrinkage (length change)	330
Figure (9-6)	Effect of WPM volume fraction on the free shrinkage of mortar bars (T = treated)	331
Figure (9-7)	Free shrinkage strain of unreinforced mortar and SWPM mortar with treated (T) and untreated (UB-UT) SWPM ($V_f=0.25\%$)	332
Figure (9-8)	Free shrinkage strain of unreinforced mortar and SWPM mortar with treated (T) and untreated (UB-UT) SWPM ($V_f=0.5\%$)	332
Figure (9-9)	Free shrinkage strain of unreinforced mortar and SWPM mortar with treated (T) and untreated (UB-UT) SWPM ($V_f=1\%$)	333
Figure (9-10)	Free shrinkage strain of unreinforced mortar and HWPM mortar with treated (T) and untreated (UT) HWPM ($V_f=0.25\%$)	333
Figure (9-11)	Effect of fiber type (Softwood vs. Hardwood) or fiber length on the free shrinkage.	334
Figure (9-12)	Shrinkage cracking in unreinforced ring samples	334
Figure (9-13)	Ring samples reinforced with 0.5% treated and untreated softwood and hardwood fibers showing no signs of cracks	335
Figure (9-14)	Shrinkage cracking measurements of unreinforced sample as an average of three reading at different places on the crack	335

SUMMARY

As an alternative to more expensive steel, glass, and synthetic polymer fibers, wood fibers are well-suited for reinforcing cement-based products due to their high strength-to-cost ratio, availability, renewability and recyclability, and non-hazardous nature. The goals of this study were: (1) to improve fiber distribution, (2) to assess how different wood pulp microfibers influence the behavior of cement-based composites, and (3) to develop a practical method for characterizing the toughness of cement-based composites measured in flexure. Toward the first objective, a method involving mechanically and chemically tailoring the fiber surface was developed to improve pulp fiber dispersion in cement-based matrices. By overcoming common problems with fiber clumping, the development of this low-cost method for improving dispersion should broaden the use of pulp fibers in cement-based composites. Assessment of the effect of pulp fiber reinforcement made through measurements of compressive strength, toughness in compression, stiffness, flexural strength and toughness, and free and restrained shrinkage showed that the use of wood fibers in cement-based composites significantly improved the toughness in both flexure and compression without having a great detrimental effect on the strength or shrinkage. Also, reinforcement with longer softwood fibers, as compared to shorter hardwood fibers, was found to produce larger increases in toughness. Finally, a new simple and practical method that uses a new set of parameters to characterize toughness in flexure has been proposed.