

TABLE OF CONTENTS

	Page
Acknowledgement	iii
Abstract (Thai)	iv
Abstract (English)	v
List of tables	viii
List of figures	xi
Chapter 1 Introduction	
1.1 Statement and significance of the problem	1
1.2 Rationale	6
1.3 Literature review	7
1.3.1 Surface treatment of fiber-reinforced post	7
1.3.1.1 Mechanical treatments	7
1.3.1.2 Chemical treatments	8
1.3.2 Definition of plasma	9
1.3.3 Classification of plasma	9
1.3.4 Effect of plasma gas	11
1.3.5 Bonding enhancement through plasma treatment	12
1.3.6 Aging effect (stability)	18
1.4 Purpose of the study	21
Chapter 2 Research design and methodology	22
2.1 Part1 The studies of bonding efficiency between the	

Plasma treated FRCP and the composite resin core build-up material and the evaluation of surface roughness of the posts of each plasma treatment group	23
2.2 Part 2 The study on the suitable parameters of plasma treatment involving the gas pressure, discharge power, and plasma treatment time which induce the optimal bonding efficiency	29
2.3 Fourier transform infrared spectroscopy (FTIR) for chemical analysis	31
2.4 Part 3 The study of hydrothermal effect on bonding stability between the FRCP and composite core build-up material	32
Chapter 3 Result	
3.1 Results of part 1	36
3.2 Results of part 2	40
3.3 Results of FTIR	47
3.4 Results of part 3	52
Chapter 4 Discussion	
4.1 Discussion of part 1	63
4.2 Discussion of part 2	66
4.3 Discussion of part 3	71
Chapter 5 Conclusion	76
References	77
Curriculum vitae	84

LIST OF TABLES

Table	Page
1 List of investigated materials.	24
2 Means (MPa) \pm s.d. of tensile-shear bond strength for all groups.	36
3 Two-way ANOVA revealed p-value<0.01 for the type of the post (type), the type of plasma treatment (treatment), and their interactions (type*treatment).	37
4 Means (μ m) \pm s.d. of surface roughness calculated for all the treatment groups.	38
5 Means (MPa) \pm s.d. of tensile-shear bond strength calculated for all gas pressure groups for FRC and DT post.	40
6 Means (MPa) \pm s.d. of tensile-shear bond strength calculated for all discharge power groups.	42
7 Means (MPa) \pm s.d. of tensile-shear bond strength calculated for all the treatment time groups.	44
8 One-way ANOVA revealed p-value<0.01 for FRC post in plasma treatment time groups.	44
9 One-way ANOVA revealed p-value<0.001 for DT post in plasma treatment time groups.	45
10 Means (MPa) \pm s.d. of the tensile-shear bond strength calculated for all treatment time groups in both storage conditions for the FRC posts.	52

- 11 Two-way ANOVA revealed p -value <0.001 for plasma treatment time (time), storage condition (condition), and their interaction (time*condition) for FRC posts. 53
- 12 Means (MPa) \pm s.d. of the tensile-shear bond strength calculated for all treatment time groups in both storage conditions for the DT posts. 54
- 13 Two-way ANOVA revealed p -value <0.001 for plasma treatment time (time), storage condition (condition), and their interaction (time*condition) for DT post. 54
- 14 Means (MPa) \pm s.d. of the tensile-shear bond strength calculated for the control and all treatment groups for the FRC posts in section 1. 56
- 15 Two-way ANOVA revealed p -value <0.001 for temperature (temp), plasma treatment (plasma Tx), and their interaction (plasmaTx* temp) for the FRC posts. 57
- 16 Means (MPa) \pm s.d. of the tensile-shear bond strength calculated for the control and all treatment groups of the DT posts in section 1. 58
- 17 Two-way ANOVA revealed p -value <0.001 for temperature (temp), plasma treatment (plasmatrix), and their interaction (temp*plasmatrix) for the DT posts. 58
- 18 Means (MPa) \pm s.d. of the tensile-shear bond strength for plasma treatment time 10 and 30 minutes in 37 °C dry and 37 °C wet storage conditions for the FRC posts in section 2. 60
- 19 Two-way ANOVA reveal p -value >0.05 for plasma treatment (plasma Tx), storage condition (condi), and their interaction

- (plasmaTx*condi) for the FRC posts in section 2. 60
- 20 Means (MPa) \pm s.d. of the tensile-shear bond strength for plasma treatment time 15 and 30 minutes in 37 °C dry and 37 °C wet storage conditions for the DT posts in section 2. 61
- 21 Two-way ANOVA reveal p-value >0.05 for storage condition (cond) but p-value <0.05 for plasma treatment (plasmatax) and their interaction (plasmatax*cond) for the DT posts in section 2. 62

LIST OF FIGURES

Figure	Page
1 Schematic illustration of cast metal post used for gaining retention for coronal restoration.	2
2 Schematic illustration of each interface between the fiber post, dentin and composite resin foundation.	5
3 Schematic illustration of plasma modification within the plasma reactor.	10
4 Schematic illustration of the reaction mechanisms of plasma surface modifications.	11
5 A possible oxidation scheme of O ₂ plasma treated PMMA.	16
6 Formation of cross-linking due to free radicals interactions.	17
7 Chemical structures of the investigated materials.	25
8 Schematic illustration of low pressure plasma generator with fiber-reinforced composite post (FRCP) on the specimen holder at the center of quartz chamber.	25
9 Schematic illustration of specimen preparation for pull-out test.	27
10 Flow-chart of the experimental procedures in division 1: Effect of plasma treatment time and hydrothermal storage condition.	33
11 Flow-chart of the experimental procedures in section 1: Thermal effect.	34
12 Flow-chart of the experimental procedures in section 2: Hydration effect.	35
13 Tensile-shear bond strengths (in MPa) for all groups displayed in a box and whisker plot.	37

14	Light microscopic image of the debonded surfaces of FRC and DT posts: (a, b) debonded surfaces of FRC Postec: (c, d) debonded surface of DT Light-Post.	39
15a	Tensile-shear bond strengths (MPa) for all gas pressure groups for FRC post.	40
15b	Tensile-shear bond strengths (MPa) for all gas pressure groups for DT post.	41
16a	Tensile-shear bond strengths (MPa) for all discharge power groups for FRC post.	42
16b	Tensile-shear bond strengths (MPa) for all discharge power groups for DT post.	43
17a	Tensile shear bond strengths (MPa) for all the treatment time groups for the FRC posts.	45
17b	Tensile shear bond strengths (MPa) for all the treatment time groups for the DT posts.	46
18a	FTIR spectra of the untreated post (above) and the plasma-treated post (below) of the FRC post.	48
18b	FTIR spectra of the untreated post (above) and the plasma treated post (below) of the DT posts.	49
19a	EDX spectra of the untreated and plasma treated-FRC posts.	50
19b	EDX spectra of the untreated and plasma treated-DT posts.	51
20	Tensile-shear bond strengths (MPa) for all treatment time groups in both storage conditions for the FRC posts.	53
21	Tensile-shear bond strengths (MPa) for all treatment time groups in both storage conditions for the DT posts.	55
22	Tensile-shear bond strengths (MPa) for the control and all	

treatment groups for the FRC posts in section 1.	57
23 Tensile-shear bond strengths (MPa) for the control and all treatment groups for the DT posts in section 1.	59
24 Tensile-shear bond strengths (MPa) for plasma treatment time 10 and 30 minutes in 37 °C dry and 37 °C wet storage conditions for the FRC posts in section 2.	61
25 Tensile-shear bond strengths (MPa) for plasma treatment time 15 and 30 minutes in 37 °C dry and 37 °C wet storage conditions for the DT posts in section 2.	62
26 Ion collisions in a sheath between the plasma and a workpiece.	67
27 Dimethacrylate groups (square label) in TGDMA and UDMA of FRC post.	69
28 oxirane structure (square label) of epoxy resin of DT post.	69
29 Schematic illustration of hydrogen bond between the Induced-functional groups on the fiber-reinforced post and the CH ₃ groups in the composite core build-up material.	73