

The Synthesis,
Physical Properties,
Bioactivity and
Potential Applications
of Polyanilines

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By

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Graham Bowmaker and Zoran Zujovic

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TABLE OF CONTENTS

List of Illustrations	x
List of Tables	xxvii
Preface	xxx
List of Symbols and Abbreviations	xxxiii
English Symbols	xxxiii
Greek Symbols.....	xxxv
Chapter One.....	1
Polyaniline: Chemical Synthesis and Characterisation	
1.1. Introduction.....	1
1.2. History of PANI.....	1
1.3. Oxidation states.....	2
1.4. Mechanism of oxidative polymerisation of aniline.....	3
1.5. Synthesis of PANI.....	5
1.5.1. Chemical synthesis.....	5
1.5.2. Reaction medium.....	6
1.5.3. Concentration of the oxidant	6
1.5.4. Reaction time.....	7
1.5.5. Effect of the temperature.....	7
1.5.6. Example of synthesis of EB-PANI.....	8
1.5.7. Preparation of reduced PANI (R-PANI) with hydrazine.....	8
1.6. Characterisation of PANI.....	9
1.6.1. Gel Permeation Chromatography (GPC).....	9
1.6.2. Spectroscopic methods.....	10
1.6.3. Conductivity.....	25
1.7. Doping of PANI.....	27
1.7.1. HCl doped PANI.....	27
1.7.2. Iodine doped PANI.....	37
1.8. Conclusion	45
1.9. References.....	46

Chapter Two	52
Functionalised Polyanilines - competitive advantages: synthesis, characterisation and processability	
2.1. Introduction.....	52
2.2. Synthesis, yield and elemental composition	53
2.2.1. Chemical synthesis	53
2.2.2. Yield, elemental composition and conductivity	54
2.3. Effect on Solubility and Conductivity.....	56
2.4. Characterisation	57
2.4.1. UV-Vis spectroscopy	57
2.4.2. FTIR spectroscopy	59
2.4.3. Raman spectroscopy.....	61
2.4.4. SEM.....	63
2.4.5. EPR spectroscopy.....	63
2.4.6. ¹³ C CP MAS NMR spectroscopy	64
2.5. Conclusion	67
2.6. References.....	67
 Chapter Three	 70
Self-assembled Nanostructured Aniline Oxidative Polymerisation Products: Formation and morphologies of nanotubes	
3.1 Introduction.....	70
3.2. Formation of PANI nanotubes	72
3.3. Structure of aniline oxidative polymerisation products in the “falling pH” reaction	74
3.3.1. Synthesis and description of products	76
3.3.2. SEM.....	77
3.3.3. GPC studies	78
3.3.4. UV-Vis spectroscopy	78
3.3.5. FTIR spectra.....	80
3.3.6. Solid-state NMR (SS NMR) of products obtained during the “falling pH” reaction	81
3.4. The role of aniline oligomeric nanosheets in formation of PANI nanotubes	91
3.4.1. “Falling pH” experiment	92
3.4.2. The pH-stat experiments	93
3.4.3. Standard synthesis of PANI	94
3.4.4. SEM and TEM	94
3.4.5. FTIR spectroscopy	97
3.4.6. UV-Vis spectroscopy	99
3.4.7. XRD measurements.....	100

3.4.8. Proposed molecular structure of early formed product during the “falling pH” reaction	101
3.5. The reactions involved in formation of early formed nanostructures	107
3.5.1. SEM and TEM	109
3.5.2. XRD measurements.....	113
3.6. Self-assembled Films at the Air/Liquid Interface	114
3.6.1. Syntheses and Samples.....	115
3.6.2. SEM and TEM	116
3.7. Conclusion	118
3.8. References.....	119
 Chapter Four.....	 126
Polyaniline and Functionalised Polyanilines as radical scavengers	
4.1. Introduction.....	126
4.2. Radical scavenging ability of PANI and fPANIs. Comparison of the antioxidant ability of PANI and fPANIs with their related monomers and other CPs.....	127
4.3. DPPH studies monitored by spectroscopic methods.....	130
4.3.1. UV-Vis spectroscopy	130
4.3.2. FTIR spectroscopy	134
4.3.3. XPS spectroscopy.....	137
4.3.4. EPR spectroscopy.....	138
4.3.5. SS NMR studies	142
4.3.6. Radical scavenging abilities of nanostructured PANI and fPANIs.....	154
4.4. ABTS assay. Comparison of DPPH and ABTS scavenging abilities of CPs.....	156
4.4.1. ABTS assay	156
4.4.2. Comparison of DPPH and ABTS scavenging abilities of CPs.....	158
4.5. Conclusion	161
4.6. References.....	162
 Chapter Five	 166
Electrospun Polyaniline based nanofibres blends and their potential biomedical applications	
5.1. Introduction.....	166
5.2. Electrospinning method	168
5.3. Solution preparation for electrospinning.....	170
5.4. Characterisation	171

5.4.1. Morphology of the electrospun PANI and fPANI based fibres	171
5.4.2. FTIR and Raman spectroscopy	177
5.4.3. Mechanical and electrical properties of PANI or fPANI-biopolymer blend fibres.....	178
5.5. Cell proliferation and biocompatibility	180
5.6. Antimicrobial properties of electrospun nanofibres	184
5.7. Conclusion	186
5.8. References.....	187
 Chapter Six	 190
Broad spectrum of antimicrobial activity of Polyaniline and Functionalised Polyanilines	
6.1. Introduction.....	190
6.2. Antimicrobial efficacy of PANI and fPANIs.....	192
6.2.1. Minimum inhibitory concentration (MIC) of PANI and fPANI	194
6.2.2. Bactericidal activity of fPANI.....	198
6.2.3. Antifungal and antiviral efficacy of PANI and fPANIs ...	200
6.2.4. Gene array analysis of fPANI.....	201
6.3. Anti-Biofilm properties of fPANIs	206
6.3.1. Quantification of biofilm formation by crystal violet staining method	208
6.3.2. Fluorescent staining of biofilms and microscopic analysis	211
6.4. The tuberculocidal activity of PANI and fPANIs	215
6.4.1. Antibacterial action of surface incorporated PANI and fPANI (P3ABA) against <i>M. smegmatis</i> BSG20, <i>M. tuberculosis</i> BSG001 and clinical isolate <i>M. tuberculosis</i> BSG002	216
6.5. Conclusion	218
6.6. References.....	220
 Chapter Seven.....	 224
Microwave synthesis: rapid and facile novel method of synthesis of nanostructured polyaniline based polymers	
7.1 Introduction.....	224
7.2. Microwave irradiation – theoretical background and applications.....	225
7.2.1. The acceleration of chemical reactions using MW.....	227
7.2.2. Thermal vs. non-thermal effects.....	228

7.3. An overview of the conventional microwave synthesis of PANI compounds.....	229
7.4. The enhanced microwave synthesis (EMS) of PANI.....	230
7.4.1. Microwave synthesis and apparatus	231
7.4.2. SEM and TEM measurements.....	232
7.4.3. Spectroscopic studies	234
7.5. EMS of Functionalised PANI (fPANI)	237
7.5.1. Microwave synthesis	238
7.5.2. Microwave Irradiation Effect on Yield	238
7.5.3. GPC studies.....	239
7.5.4. SEM measurements.....	240
7.5.5. Spectroscopic measurements.....	242
7.5.6. The formation mechanism.....	246
7.6. EMS of PANI - a dependence on MW power.....	248
7.6.1. EMS of PANI at different MW powers.....	248
7.6.2. Effects of different microwave irradiation power on yield.....	249
7.6.3. GPC Studies	250
7.6.4. SEM Measurements	251
7.6.5. Effects of different microwave irradiation power on surface area.....	252
7.6.6. Spectroscopic measurements.....	253
7.6.7. The Effects of MW power on the PANI synthesis	256
7.7. EMS of PANI – the dependence on pH	257
7.7.1. The Effects of acid media on the PANI synthesis (low pH syntheses)	258
7.7.2. The Effects of acid media on the PANI synthesis (medium and high pH syntheses).....	266
7.8. EMS of PANI/C ₆₀ nanocomposites.....	275
7.8.1. Synthesis of PANI/C ₆₀ nanocomposites and Yield.....	275
7.8.2. SEM and TEM measurements.....	276
7.8.3. Spectroscopy measurements: FTIR and UV-Vis.....	278
7.9. Conclusion	279
7.10. References.....	280
Index.....	288

LIST OF ILLUSTRATIONS

Schemes

Scheme 1-1 Oxidation states of PANI.....	3
Scheme 1-2 The most generalised mechanism of An polymerisation.	4
Scheme 1-3 Doping mechanism of EB-PANI with HCl acid.....	28
Scheme 1-4 Mechanism for iodine doping of EB-PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier.....	44
Scheme 2-1 General structure of 2ABAPANI, 3ABAPANI and 3EABPANI copolymers. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Eastal, A. J. and Bowmaker, G. A., “Chemical synthesis of poly(aniline-co-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons.....	55
Scheme 3-1 The further oxidation of ortho-coupled An in cooperation with intramolecular cyclization (B) produces phenazine units.	72
Scheme 3-2 The chemical structure of PANI.....	75
Scheme 3-3 The structural formula of the amino acid alanine.....	76
Scheme 3-4 Proposed structural units present in the nanostructured An oxidation products.....	91
Scheme 3-5 Possible structures of An oxidation products and the degree of oxidation (DO) involved in their formation from An.	102
Scheme 3-6 Possible structures of An oxidation products containing phenazine units and the degree of oxidation (DO) involved in their formation from An.....	103
Scheme 3-7 Possible structures of An oxidation products containing N-phenylphenazine units and the degree of oxidation (DO) involved in their formation from An.....	104
Scheme 3-8 The proposed structure of oligomeric products formed during the early stage of the “falling pH” reaction.....	105
Scheme 7-1 Proposed structural units present in the nanostructured aniline oxidation products obtained at different power levels. Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z.	

“Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. 273

Figures

Fig. 1-1 GPC chromatogram for EB-PANI sample. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier.	10
Fig. 1-2 UV-Vis spectrum of 0.02 wt% EB-PANI sample in NMP. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier.	11
Fig. 1-3 FTIR spectrum of EB-PANI sample. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier.	12
Fig. 1-4 FTIR spectrum of R-PANI sample.	13
Fig. 1-5 Raman spectrum of EB-PANI sample (785 nm excitation).	14
Fig. 1-6 Raman spectrum of EB-PANI sample (488 nm excitation).	16
Fig. 1-7 Raman spectrum of R-PANI sample (488 nm excitation).	17
Fig. 1-8 EPR spectra of EB-PANI and R-PANI.	19
Fig. 1-9 Integrated intensity of EPR spectrum of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ standard as a function of the amount of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	20
Fig. 1-10 Solid sample rotation at an angle to the applied magnetic field B_0 , showing the geometric relationships involved.	22
Fig. 1-11 ^{13}C CP MAS NMR spectra of (A) R-PANI and (B) EB-PANI.	25
Fig. 1-12 Raman spectrum of 1 M HCl doped PANI (488 nm excitation).	29
Fig. 1-13 FTIR spectrum of 1 M HCl doped PANI.	29
Fig. 1-14 EPR spectra of HCl doped PANI and EB-PANI samples.	30
Fig. 1-15 Spin number (n_0) as a function of dopant HCl concentration. ...	32
Fig. 1-16 Relationship between doping percentage of PANI and equilibrium pH of HCl “doping” solution.	34
Fig. 1-17 Calculated Cl/N molar ratio for PANI samples as a function of pH.	35
Fig. 1-18 Relationship between conductivity and percentage doping of HCl doped PANI samples.	36
Fig. 1-19 Mid-FTIR spectrum of iodine doped PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A.,	

- “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier. 38
- Fig. 1-20 Far-FTIR spectrum of iodine doped PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier. 39
- Fig. 1-21 EPR spectrum of EB-PANI sample before and after doping with iodine. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier. 42
- Fig. 1-22 ^{13}C CP MAS NMR spectrum of iodine doped PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., “Iodine vapour doped polyaniline”, 3070-3075, Copyright (2008), with permission from Elsevier. 43
- Fig. 2-1 FTIR spectra of the copolymers in EB forms. (A) 3ABAPANI 1:1, (B) 3EABPANI 1:1, (C) 3EABPANI 1:2, (D) 3EABPANI 2:1, and (E) homopolymer P3EAB. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Easteal, A. J. and Bowmaker, G. A., “Chemical synthesis of poly(aniline-*co*-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons..... 60
- Fig. 2-2 Raman spectra of the copolymers: (A) 3ABAPANI 1:1 ES, (B) 3EABPANI 1:1 ES, (C) 3ABAPANI 1:1 EB and (D) 3EABPANI 1:1 EB. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Easteal, A. J. and Bowmaker, G. A., “Chemical synthesis of poly(aniline-*co*-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons..... 62
- Fig. 2-3 The SEM micrograph of (A) 3EABPANI 1:1, and (B) P3EAB. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Easteal, A. J. and Bowmaker, G. A., “Chemical synthesis of poly(aniline-*co*-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons. 63
- Fig. 2-4 ^{13}C CPMAS NMR spectra of the copolymers in EB forms. (A) 3ABAPANI 1:1, (B) 3EABPANI 1:1, (C) 3EABPANI 1:2 and (D) 3EABPANI 2:1. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Easteal, A. J. and Bowmaker, G. A., “Chemical synthesis of

- poly(aniline-*co*-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons..... 65
- Fig. 2-5 Series of spectral editing (^{13}C NQS) at 0.0057 ms for the copolymers in EB forms. (A) 3ABAPANI 1:1, (B) 3EABPANI 1:1, (C) 3EABPANI 1:2, (D) 3EABPANI 2:1. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Eastal, A. J. and Bowmaker, G. A., “Chemical synthesis of poly(aniline-*co*-ethyl-3-aminobenzoate) copolymers”, 1339-1347, Copyright (2010), with permission from John Wiley and Sons..... 66
- Fig. 3-1 The mechanism proposed by Stejskal et al. [24] for the formation of PANI nanotubes..... 74
- Fig. 3-2 SEM micrographs of the An oxidation products synthesised using APS in the presence of alanine, obtained after 1 h (A), 3 h (B), and 20 h (C) reaction time. Reprinted with permission from Zujovic, Z. D.; Zhang, L.; Bowmaker, G. A.; Kilmartin, P. A.; Travas-Sejdic, J. *Macromolecules* 2008, 41, (9), 3125-3135. Copyright (2008) American Chemical Society..... 77
- Fig. 3-3 UV-Vis spectra of the 1 h (dashed line) and 20 h (solid line) reaction time samples dissolved in *N*-methylpyrrolidone. Reprinted with permission from Zujovic, Z. D.; Zhang, L.; Bowmaker, G. A.; Kilmartin, P. A.; Travas-Sejdic, J. *Macromolecules* 2008, 41, (9), 3125-3135. Copyright (2008) American Chemical Society..... 79
- Fig. 3-4 FTIR spectra of An oxidation products synthesised with APS in the presence of alanine, (A) after 1 h reaction time, (B) the same sample after reaction with hydrazine, (C) after 20 h reaction time, (D) the same sample after reaction with LiOH. Reprinted with permission from Zujovic, Z. D.; Zhang, L.; Bowmaker, G. A.; Kilmartin, P. A.; Travas-Sejdic, J. *Macromolecules* 2008, 41, (9), 3125-3135. Copyright (2008) American Chemical Society..... 80
- Fig. 3-5 The SS ^{13}C CP MAS NMR spectra of An oxidation products synthesised using APS in the presence of alanine; after 1 h reaction time (A), after 1 h reaction time and reduced with hydrazine (B), after 20 h reaction time (C), after 20 h reaction time and dedoped with NH_4OH (D), after 20 h reaction time and dedoped with LiOH (E). The asterisks denote spinning sidebands. Reprinted with permission from Zujovic, Z. D.; Zhang, L.; Bowmaker, G. A.; Kilmartin, P. A.; Travas-Sejdic, J. *Macromolecules* 2008, 41, (9), 3125-3135. Copyright (2008) American Chemical Society..... 83
- Fig. 3-6 SS ^{15}N CP MAS NMR spectra of the sample synthesised with alanine by oxidation with APS; 1 h reaction time (A), 1 h reaction time

- and reduced with hydrazine (B) 20 h reaction time (C), 20 h reaction time and dedoped with LiOH (D). Reprinted with permission from Zujovic, Z. D.; Zhang, L.; Bowmaker, G. A.; Kilmartin, P. A.; Travas-Sejdic, J. *Macromolecules* 2008, 41, (9), 3125-3135. Copyright (2008) American Chemical Society..... 87
- Fig. 3-7 TEM (a, c, d, e, f, h) and SEM (b, g) micrographs of: the "falling pH 1 h" sample (a) "falling pH 20 min" sample at ambient temperature (b, c, d, e, f), and "pH 2.5 20 h" sample (g, h). Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Bowmaker, G. A.; Kilmartin, P. A.; Webber, A. L.; Brown, S. P.; Travas-Sejdic, J. *Macromolecules* 2010, 43, (2), 662-670. Copyright (2009) American Chemical Society. 94
- Fig. 3-8 TEM micrographs of the "falling pH 1 h" sample (a, b, c) along with the corresponding schemes which illustrate different thicknesses. Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Bowmaker, G. A.; Kilmartin, P. A.; Webber, A. L.; Brown, S. P.; Travas-Sejdic, J. *Macromolecules* 2010, 43, (2), 662-670. Copyright (2009) American Chemical Society. 96
- Fig. 3-9 TEM (a, c) and SEM (b) micrographs of the "pH 2.5 20 h" sample. Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Bowmaker, G. A.; Kilmartin, P. A.; Webber, A. L.; Brown, S. P.; Travas-Sejdic, J. *Macromolecules* 2010, 43, (2), 662-670. Copyright (2009) American Chemical Society. 96
- Fig. 3-10 FTIR spectra of the "falling pH 1 h", A and "pH 2.5 20 h", B samples. Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Bowmaker, G. A.; Kilmartin, P. A.; Webber, A. L.; Brown, S. P.; Travas-Sejdic, J. *Macromolecules* 2010, 43, (2), 662-670. Copyright (2009) American Chemical Society. 97
- Fig. 3-11 UV-Vis spectra of the "falling pH 1 h", A and "pH 2.5 20 h", B samples. Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Bowmaker, G. A.; Kilmartin, P. A.; Webber, A. L.; Brown, S. P.; Travas-Sejdic, J. *Macromolecules* 2010, 43, (2), 662-670. Copyright (2009) American Chemical Society. 99
- Fig. 3-12 XRD pattern of the "falling pH 1 h", A and "pH 2.5 20 h", B samples. 100
- Fig. 3-13 SEM images of the products obtained during the oxidative polymerisation of An in the presence of 24 mM HCl. Samples are extracted at the 15 min (A-C), 45 min (D-F), 3 h (G-I) and 24 h (J-L) duration of An polymerisation (24 mM An and APS). Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Travas-Sejdic, J.

- Chemistry – An Asian Journal* 2011, 6, (3), 791-796. Copyright (2011) John Wiley and Sons..... 110
- Fig. 3-14 TEM images of the products obtained during the oxidative polymerisation of An in the presence of 4mM HCl: 1 min (A, B) and 5 min (C, D), (24 mM An and APS) and 6 min (E, F), (4 mM An and APS). Reprinted with permission from Zujovic, Z. D.; Laslau, C.; Travas-Sejdic, J. *Chemistry – An Asian Journal* 2011, 6, (3), 791-796. Copyright (2011) John Wiley and Sons..... 111
- Fig. 3-15 XRD patterns of the products obtained during the oxidative polymerisation of An with APS in the presence of 4 mM HCl. Samples are extracted at the 5 min (A), 45 min (B), 3 h (C) and 24 h (D) duration of An polymerisation (24 mM An and APS). 113
- Fig. 3-16 The SEM micrographs of the films of: the sample B (a, b), the sample A, (c, d) and the sample C, (e, f) obtained after the oxidative polymerisation of An in the aqueous solution of ammonium persulfate and hydrochloric acid. The samples are ordered according to the increase of an An concentration in the reaction solution (7.5 B, 30 A and 120 mM C). Reprinted with permission from Zujovic, Z. D.; Metson, J. B. *Langmuir* 2010, 27, (12), 7776-7782. Copyright (2010) American Chemical Society..... 116
- Fig. 3-17 The TEM micrographs of the films of: the sample B (a), and the sample C, (b) obtained after the oxidative polymerisation of An in the aqueous solution of APS and HCl. The presence of nanorods is highlighted with the arrow in the insert (a). Reprinted with permission from Zujovic, Z. D.; Metson, J. B. *Langmuir* 2010, 27, (12), 7776-7782. Copyright (2010) American Chemical Society..... 117
- Fig. 4-1 Linear sweep voltammograms of (a) 1 mM aniline and 1 mM *o*-methoxyaniline, (b) 20 % w/v polyaniline grafted to lignin diluted to 0.1 M of aniline units and 5 % w/v poly(anilinesulfonic acid) diluted to 0.02 M aniline units, and (c) 0.05 mM epigallocatechin gallate and 0.05 mM catechin, taken at a 3 mm carbon electrode in a pH 7.0 phosphate buffer at a scan rate of 100 mV s⁻¹. Reprinted from Synthetic metals, 140, Gizdavic-Nikolaidis, M.; Travas-Sejdic, J.; Bowmaker, G. A.; Cooney, R. P. and Kilmartin P. A., "Conducting polymers as free radical scavengers", 225-232, Copyright (2004), with permission from Elsevier. 129
- Fig. 4-2 UV-Vis spectra of DPPH in MeOH solutions of different amounts (m) of An. Spectrum labeled 1 corresponds to DPPH solution-before mixing, Spectra 2-9 m(mg) = 0.051; 0.254; 0.505; 0.754; 1.00; 1.962; 2.429; 2.886. Reprinted from Current Applied Physics, 4, Gizdavic-Nikolaidis, M.; Travas-Sejdic, J.; Kilmartin P. A.; Bowmaker, G. A.

and Cooney, R. P., “Evaluation of antioxidant activity of aniline and polyaniline”, 343-346, Copyright (2004), with permission from Elsevier.	131
Fig. 4-3 UV-Vis absorption spectra of DPPH (7.1×10^{-5} mol L ⁻¹) in MeOH solutions in contact with different amounts (m) of PANI.	132
Fig. 4-4 UV-Vis absorption spectra of DPPH radicals in methanol (7.1×10^{-5} mol L ⁻¹) after 30 min exposure to nil, a) 0.005 μ L, b) 0.01 μ L, c) 0.02 μ L, d) 0.05 μ L of a 20 % w/v solution of short-chain PANI grafted to lignin produced by Sigma-Aldrich. Reprinted from Synthetic metals, 140, Gizdavic-Nikolaidis, M.; Travas-Sejdic, J.; Bowmaker, G. A.; Cooney, R. P. And Kilmartin P. A., “Conducting polymers as free radical scavengers”, 225-232, Copyright (2004), with permission from Elsevier.	133
Fig. 4-5 Decline in the absorption at 516 nm for 1.5 mL of 72 μ M DPPH free radical in MeOH added to (a) 0.02 μ L of 20 % w/v PANI grafted to lignin, and (b) 8 μ L of aniline (An) monomer. Reprinted from Synthetic metals, 140, Gizdavic-Nikolaidis, M.; Travas-Sejdic, J.; Bowmaker, G. A.; Cooney, R. P. And Kilmartin P. A., “Conducting polymers as free radical scavengers”, 225-232, Copyright (2004), with permission from Elsevier.	134
Fig. 4-6 FTIR spectrum of DPPH radicals.	135
Fig. 4-7 Infrared spectra of R-PANI powder after soaking in methanol, then drying in vacuum, a) before, b) after reaction with DPPH radicals.	136
Fig. 4-8 The difference between FTIR spectra of R-PANI and R-PANI after reaction with DPPH.	136
Fig. 4-9 FTIR spectra of EB-PANI powder after soaking in MeOH, then drying in vacuum, (a) before, and (b) after reaction with DPPH radicals.	137
Fig. 4-10 N1s XPS of PANI-DPPH showing the imine and amine contributions. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ¹⁵ N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier.	138
Fig. 4-11 EPR spectra of ES-PANI before and after reaction with DPPH recorded with receiver gain 25.	139
Fig. 4-12 EPR spectra of the DPPH radical in methanol, and at various times after adding a PPy-containing solution, recorded with receiver gain 2.5×10^4 . Reprinted from Synthetic metals, 153, Kilmartin, P. A.; Gizdavic-Nikolaidis, M.; Zujovic, Z. D.; Travas-Sejdic, J.; Bowmaker,	

G. A. and Cooney, R. P., “Free radical scavenging and antioxidant properties of conducting polymers examined using EPR and NMR spectroscopies”, 153-156, Copyright (2005), with permission from Elsevier.	140
Fig. 4-13 Change in the integrated DPPH signal for reaction with a PPy-containing solution; a) integrated signal intensity with time, and b) log of the integrated signal intensity, showing pseudo-first order kinetics from 4 to 160 min. Reprinted from Synthetic metals, 153, Kilmartin, P. A.; Gizdavic-Nikolaidis, M.; Zujovic, Z. D.; Travas-Sejdic, J.; Bowmaker, G. A. and Cooney, R. P., “Free radical scavenging and antioxidant properties of conducting polymers examined using EPR and NMR spectroscopies”, 153-156, Copyright (2005), with permission from Elsevier.	141
Fig. 4-14 The ^{13}C CP MAS NMR spectra of EB-PANI (a) and EB-PANI after reaction with DPPH (b). The asterisks indicate spinning sidebands.	143
Fig. 4-15 The ^{13}C CP MAS NMR spectra of R-PANI (a) and R-PANI after reaction with DPPH (b). The asterisks indicate spinning sidebands.	146
Fig. 4-16 The ^{13}C CP MAS NMR spectra of ^{15}N labelled EB-PANI (A) and ^{15}N labelled EB-PANI after reaction with DPPH (B). The asterisks indicate spinning sidebands.	147
Fig. 4-17 The ^{15}N CP MAS NMR spectra of ^{15}N labelled EB-PANI (A) and ^{15}N labelled EB-PANI after reaction with DPPH (B). The asterisks indicate spinning sidebands. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ^{15}N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier.	148
Fig. 4-18 The peak areas of the amine (A) and the imine (B) versus cross polarisation contact time for the original sample of EB-PANI. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ^{15}N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier.	150
Fig. 4-19 The peak areas of the amine (A) and the imine (B) versus cross polarisation contact time for the original sample of EB-PANI-DPPH. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ^{15}N labelled polyaniline	

- upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier. 151
- Fig. 4-20 ^1H NMR relaxation measurements in the rotating frame of coordinates for EB-PANI (B-amine, D-imine) and EB-PANI-DPPH (A-amine, C-imine). Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ^{15}N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier. 153
- Fig. 4-21 UV-Vis absorption spectra of DPPH radical 30 min after the addition of 3EABPANI-PLA blends. The amounts of 3EABPANI in the samples were (1) 0, (2) 5, (3) 15, (4) 30 and (5) 45 μg . Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 49, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Swift, S.; Bowmaker, G. A. and Easteal, A. J., “Bioactive electrospun poly(aniline-*co*-ethyl 3 aminobenzoate)/poly(lactic acid) nanofibres for tissue engineering”, 4902-4910, Copyright (2011), with permission from John Wiley and Sons. 155
- Fig. 5-1 SEM micrographs of neuron-like nanostructures formed from (a) pure biopolymer (PLA); and (b-e) 3EABPANI-PLA 15:85 with needle-collector separation/electric field (b) 6 cm/10 kV, (c) 7 cm/10 kV, (d) 8 cm/10 kV, (e) 8 cm/12 kV. (f) The relationship between average nanofibre diameter and applied voltage in the electrospinning of blend nanofibres. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 49, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Swift, S.; Bowmaker, G. A. and Easteal, A. J. “Bioactive electrospun poly(aniline-*co*-ethyl 3 aminobenzoate)/poly(lactic acid) nanofibres for tissue engineering”, 4902-4910, Copyright (2011), with permission from John Wiley and Sons. 174
- Fig. 5-2 SEM micrographs of honeycomb-like nanofibrous mats. (a) 3EABPANI-PLA 30:70, and (b) 3EABPANI-PLA 45:55. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 49, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Swift, S.; Bowmaker, G. A. and Easteal, A. J. “Bioactive electrospun poly(aniline-*co*-ethyl 3 aminobenzoate)/poly(lactic acid) nanofibres for tissue engineering”, 4902-4910, Copyright (2011), with permission from John Wiley and Sons. 175
- Fig. 5-3 SEM images of the products of electrospinning solutions of (a) PLA, (b) PANI-PLA (0.84 wt%), (c) PANI-PLA (3.27 wt%), (d) PANI-PLA (5.13 wt%), (e) 3ABAPANI-PLA (60/40) (1.52 wt%), (f) 3ABAPANI-PLA (60/40) (2.99 wt%) and (g) 3ABAPANI-PLA

(60/40) (5.80 wt%). Reprinted from *Synthetic Metals*, 160, Rahman, N. A.; Gizdavic-Nikolaidis, M.; Ray, S.; Easteal, A. J.; Travas-Sejdic, J., “Functional electrospun nanofibres of poly(lactic acid) blends with polyaniline or poly(aniline-co-benzoic acid)”, 2015-2022, Copyright (2010), with permission from Elsevier..... 176

Fig. 5-4 FTIR and Raman spectra of (a) and (c) PANI-PLA nanofibres; (b) and (d) PLA/3ABAPANI-PLA (60/40) nanofibres. Reprinted from *Synthetic Metals*, 160, Rahman, N. A.; Gizdavic-Nikolaidis, M.; Ray, S.; Easteal, A. J.; Travas-Sejdic, J., “Functional electrospun nanofibres of poly(lactic acid) blends with polyaniline or poly(aniline-co-benzoic acid)”, 2015-2022, Copyright (2010), with permission from Elsevier..... 177

Fig. 5-5 COS-1 fibroblast proliferation on 3EABPANI-PLA substrates. Reprinted from *Journal of Polymer Science Part A: Polymer Chemistry journal*, 49, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Swift, S.; Bowmaker, G. A. and Easteal, A. J. “Bioactive electrospun poly(aniline-co-ethyl 3 aminobenzoate)/poly(lactic acid) nanofibres for tissue engineering”, 4902-4910, Copyright (2011), with permission from John Wiley and Sons..... 180

Fig. 5-6 COS-1 fibroblast proliferation on 3ABAPANI-PLA substrates. Reprinted from *Macromolecular Bioscience*, 10, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Easteal, A. J. and Cooney, R. P. “Electrospun functionalised polyaniline copolymer-based nanofibres with potential application in tissue engineering”, 1424-1431, Copyright (2010), with permission from John Wiley and Sons..... 181

Fig. 5-7 Cell morphology and biocompatibility. SEM micrographs of COS-1 cells growing on (a) glass, (b) PLA and (c) 3ABAPANI-PLA substrates. Reprinted from *Macromolecular Bioscience*, 10, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Easteal, A. J. and Cooney, R. P. “Electrospun functionalised polyaniline copolymer-based nanofibres with potential application in tissue engineering”, 1424-1431, Copyright (2010), with permission from John Wiley and Sons..... 183

Fig. 5-8 COS-1 fibroblast cells growth on 3EABPANI-PLA 45:55. a) phase contrast, b) SYTO-9 and c) PI. Reprinted from *Journal of Polymer Science Part A: Polymer Chemistry journal*, 49, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Swift, S.; Bowmaker, G. A. and Easteal, A. J. “Bioactive electrospun poly(aniline-co-ethyl 3 aminobenzoate)/poly(lactic acid) nanofibres for tissue engineering”, 4902-4910, Copyright (2011), with permission from John Wiley and Sons..... 184

- Fig. 5-9 Antimicrobial activity against *Staphylococcus aureus* 6838 at 10^6 CFU mL⁻¹. Substrate [% live cells]: (a) glass [98], (b) PLA [95], (c) 45:55 3ABAPANI-PLA [31]. Reprinted from Macromolecular Bioscience, 10, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Eastale, A. J. and Cooney, R. P. “Electrospun functionalised polyaniline copolymer-based nanofibres with potential application in tissue engineering”, 1424-1431, Copyright (2010), with permission from John Wiley and Sons..... 185
- Fig. 6-1 TEM image of *E. coli* bacterium after interaction with 3ABAPANI (ES). 193
- Fig. 6-2 Bactericidal effect of 3ABAPANI (ES) on *S. aureus*, *E. coli* and *P. aeruginosa*. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Eastale, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier. 199
- Fig. 6-3 Effects of two fPANI, 3ABAPANI (ES) and Poly-SO₃H, on the growth of *E. coli* and *P. aeruginosa*. An aliquot (100 μL) of a stationary-phase culture of each strain was spread on to BHI agar plates before clusters (~ 50 mg) of each polymer was added to the centre of each plate. Zones of growth inhibition were observed after the plates were incubated overnight at 37 °C. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Eastale, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier. 199
- Fig. 6-4 Total RNA was extracted from control and Poly-SO₃H-treated exponential cultures of *E. coli* strain MG1655. The expression of *katE* (catalase), *sdhB* (succinate dehydrogenase), *fumC* (fumarate hydratase), *ibpB* (heat shock protein), *iscS* (cysteine desulfurase), *spy* (stress induced periplasmic protein) and *grxA* (glutaredoxin 1) were assessed by quantitative RT-PCR. Expression was standardised to *rrsG* (16S ribosomal RNA) control expression. *, $p < 0.05$ and ** $p < 0.01$. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Eastale, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier. 204
- Fig. 6-5 Total RNA was extracted from control and Poly-SO₃H-treated exponential cultures of *E. coli* strain MG1655. The expression of *asr* was assessed by quantitative RT-PCR. Expression was standardized to *rrsG* control expression. **, $p < 0.01$. Reprinted from Acta

- Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Easteal, A. J. and Ambrose, M., "Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines", 4204-4209, Copyright (2011), with permission from Elsevier. 205
- Fig. 6-6 Bactericidal effect of PSO_3H on wild-type and mutant *E. coli* BW25113 strains. Strains are wild-type[■], *sodA*[●], and *katE* [▲]. A suspension of 12.5 mg mL^{-1} Poly- SO_3H was made in 5 mL of BHI broth. Thereafter suspensions were inoculated with microorganisms at $1 \times 10^6 \text{ CFU mL}^{-1}$ and incubated with shaking at 37°C . Samples of $100 \mu\text{L}$ were taken at time intervals, ten-fold serially diluted in BHI broth, and from each dilution $100 \mu\text{L}$ was spread over the entire BHI agar surface plate with a glass rod. Before colonies were counted, the BHI agar plates were incubated for 48 h at to allow any slow growing cells to develop in full-sized colonies. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Easteal, A. J. and Ambrose, M., "Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines", 4204-4209, Copyright (2011), with permission from Elsevier. 206
- Fig. 6-7 Representative light microscopy photographs of *P. aeruginosa* (PAO1), *S. aureus*, and *P. aeruginosa* (AESIII). Biofilms were allowed to form for 72 h in a 96-well microtiter plate at 37°C in the presence and absence of Poly- SO_3H . Appropriately treated biofilms were photographed at $\times 320$ magnification. Similar results were observed in three separate experiments. Reprinted from Colloids and Surfaces B:Biointerfaces, 136, Gizdavic-Nikolaidis, M.; Pagnon, J. C.; Ali, N.; Sum, R.; Davies, N.; Roddam, L. F. and Ambrose, M. "Functionalized polyanilines disrupt Pseudomonas aeruginosa and Staphylococcus aureus biofilms", 666-673, Copyright (2015), with permission from Elsevier. 209
- Fig. 6-8 Relative biofilm biomass recovered from biofilms of *P. aeruginosa* (PAO1), *S. aureus*, and *P. aeruginosa* (AESIII). Biofilms were allowed to form for 72 h in a 96-well microtiter plate at 37°C in the presence and absence of Poly- SO_3H . Appropriately treated biofilms were stained with 0.1 % (w/v) crystal violet solution, and the biofilm mass quantitated by spectrophotometry ($A_{500\text{nm}}$). The results are plotted as percent biofilm biomass. The error bars represent standard errors of the mean (SEM) calculated from three independent experiments. $*P < 0.01$. Reprinted from Colloids and Surfaces B:Biointerfaces, 136, Gizdavic-Nikolaidis, M.; Pagnon, J. C.; Ali, N.; Sum, R.; Davies, N.; Roddam, L. F. and Ambrose, M. "Functionalized polyanilines disrupt

- Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms”, 666-673, Copyright (2015), with permission from Elsevier. 210
- Fig. 6-9 Fluorescence microscopy images *P. aeruginosa* (PAO1), *S. aureus*, and *P. aeruginosa* (AESIII) biofilms. Biofilms were allowed to form for 48 h on glass cover slips at 37 °C in the absence of Poly-SO₃H. The 48 h old biofilms were then treated with and without 20 mg ml⁻¹ Poly-SO₃H for 24 h. Appropriately treated biofilms were stained with the Live/Dead *BacLight* staining kit. Green color (SYTO9 stain) indicates live cells, whereas red color (propidium iodide, PI) indicates dead cells. Scale bar = 100 μm. Similar results were observed in three separate experiments. Reprinted from *Colloids and Surfaces B:Biointerfaces*, 136, Gizdavic-Nikolaidis, M.; Pagnon, J. C.; Ali, N.; Sum, R.; Davies, N.; Roddam, L. F. and Ambrose, M. “Functionalized polyanilines disrupt *Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms”, 666-673, Copyright (2015), with permission from Elsevier. 212
- Fig. 6-10 *N*-(3-oxododecanoyl)-L-homoserine lactone (3OC₁₂-HSL) recovered from biofilms of *P. aeruginosa* (PAO1), and *P. aeruginosa* (AESIII). Biofilms were allowed to form for 48 h on glass cover slips at 37 °C in the absence of Poly-SO₃H. These 48 h old biofilms were then treated with and without 20 mg ml⁻¹ Poly-SO₃H for 24 h. Culture supernatants were collected from appropriately treated biofilms and 3OC₁₂-HSL extracted with acidified ethyl acetate. Samples were analysed by UPLC-MS. The results are plotted as percent 3OC₁₂-HSL recovered from biofilms. The error bars represent standard errors of the mean (SEM) calculated from duplicate experiments. **P* < 0.05. Reprinted from *Colloids and Surfaces B:Biointerfaces*, 136, Gizdavic-Nikolaidis, M.; Pagnon, J. C.; Ali, N.; Sum, R.; Davies, N.; Roddam, L. F. and Ambrose, M. “Functionalized polyanilines disrupt *Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms”, 666-673, Copyright (2015), with permission from Elsevier 213
- Fig. 6-11 Total RNA was extracted from control and Poly-SO₃H-treated stationary phase cultures of *P. aeruginosa* (PAO1). The expression of *hcnB* (hydrogen cyanide synthase), *pilA* (type IV pilus assembly protein), *lasR* (quorum-sensing transcription factor), *lasB* (elastase), *lasI* (acyl homoserine lactone synthase), and *algD* (GDP-mannose 6-dehydrogenase) were assessed by quantitative RT-PCR. Expression was standardized to *psd7* (16S ribosomal RNA) control expression. **P* < 0.05. Reprinted from *Colloids and Surfaces B:Biointerfaces*, 136, Gizdavic-Nikolaidis, M.; Pagnon, J. C.; Ali, N.; Sum, R.; Davies, N.; Roddam, L. F. and Ambrose, M. “Functionalized polyanilines disrupt

- Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms”, 666-673, Copyright (2015), with permission from Elsevier 214
- Fig. 7-1 SEM micrographs: sample from a microwave-assisted synthesis taken after 5 min (a, b); sample from a microwave-assisted synthesis taken after 20 min (c, d); sample from a chemical synthesis taken after 5 h (e, f). Reprinted from *Macromolecular Rapid Communications*, 31, Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D., “Rapid and Facile Synthesis of Nanofibrillar Polyaniline Using Microwave Radiation”, 657-661, Copyright (2010), with permission from John Wiley and Sons. 233
- Fig. 7-2 TEM micrograph of the sample from a microwave-assisted synthesis taken after 20 min. 234
- Fig. 7-3 FTIR spectra: (A), microwave-assisted synthesis sample taken after 5 min; (B), microwave-assisted synthesis sample taken after 20 min; (C), chemical synthesis sample taken after 5 h. 235
- Fig. 7-4 Raman spectra: (A), microwave-assisted synthesis sample taken after 5 min; (B), microwave-assisted synthesis sample taken after 20 min; (C), chemical synthesis sample taken after 5 h. 236
- Fig. 7-5 SEM micrographs of 2ABAPANI after 20 min under MW a) 2:1, b) 1:1, c) 1:2; and CS d) 2:1, e) 1:1 and f) 1:2 mole ratios. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D. *Microwave-Assisted Synthesis of Functionalised Polyaniline Nanostructures with Advanced Antioxidant Properties* *J. Phys. Chem. C* 2010, *114*, 18790-18796. Copyright (2010) American Chemical Society. 241
- Fig. 7-6 SEM micrographs of 2SULFOPANI after 10 min under MW a) 2:1, b) 1:1, c) 1:2; and CS d) 2:1, e) 1:1 and f) 1:2 mole ratios. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D. *Microwave-Assisted Synthesis of Functionalised Polyaniline Nanostructures with Advanced Antioxidant Properties* *J. Phys. Chem. C* 2010, *114*, 18790-18796. Copyright (2010) American Chemical Society. 242
- Fig. 7-7 FTIR spectra of 2ABAPANI after 20 min under MW a) 2:1, b) 1:1, c) 1:2; and CS d) 2:1, e) 1:1 and f) 1:2 mole ratios. 244
- Fig. 7-8 FTIR spectra of SULFOPANI after 10 min under MW a) 2:1, b) 1:1, c) 1:2; and CS d) 2:1, e) 1:1 and f) 1:2 mole ratios. 244
- Fig. 7-9 UV-Vis spectra of 2ABAPANI and 2SULFOPANI samples synthesised by CS (a, b), and MW (c, d), respectively. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D. *Microwave-Assisted Synthesis of Functionalised Polyaniline Nanostructures with Advanced Antioxidant*

- Properties *J. Phys. Chem. C* 2010, *114*, 18790-18796. Copyright (2010) American Chemical Society..... 245
- Fig. 7-10 SEM micrographs of the CS and EMS synthesised PANI using APS as oxidising agent at different power levels: A) 0 W; B) 3 W; C) 10 W; D) 40 W; E) 70 W. SEM micrographs of the CS and EMS synthesised PANI using KIO_3 as oxidising agent at different power levels: F) 0 W; G) 3 W; H) 10 W; I) 40 W; J) 70 W. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation *J. Phys. Chem. C* 2012, *116*, 3235-3241. Copyright (2012) American Chemical Society..... 251
- Fig. 7-11 FTIR spectra of the EMS and CS synthesised PANI samples using (A) KIO_3 and (B) APS as the oxidising agent, shown as a function of microwave irradiation power level. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation *J. Phys. Chem. C* 2012, *116*, 3235-3241. Copyright (2012) American Chemical Society..... 254
- Fig. 7-12 SEM micrographs of the MW synthesised PANIs at 8 W power with duration of 10 min. A) 0.5 M HCl doped PANI; B) 1 M HCl doped PANI; C) 1.5 M HCl doped PANI; D) 2 M HCl doped PANI; E) 2.5 M HCl doped PANI and F) 3 M HCl doped PANI. SEM micrographs of the MW synthesised PANIs at 93 W power with duration of 10 min. G) 0.5 M HCl doped PANI; H) 1 M HCl doped PANI; I) 1.5 M HCl doped PANI; J) 2 M HCl doped PANI; K) 2.5 M HCl doped PANI and L) 3 M HCl doped PANI. Reprinted from Current Applied Physics, 114, Jevremovic, M.; Zujovic, Z.; Stanisavljev, D. R.; Bowmaker, G. A. and Gizdavic-Nikolaidis, M. "Investigation of the effect of acid dopant on the physical properties of polyaniline prepared using microwave irradiation", 1201-1207, Copyright (2014), with permission from Elsevier. 260
- Fig. 7-13 SEM micrographs of the MW synthesised PANIs at 93 W power with duration of 10 min. A) 0.5 M H_2SO_4 doped PANI; B) 1 M H_2SO_4 doped PANI; C) 1.5 M H_2SO_4 doped PANI; D) 2 M H_2SO_4 doped PANI; E) 2.5 M H_2SO_4 doped PANI. SEM micrographs of the CS synthesised PANIs with duration of 10 min. F) 0.5 M H_2SO_4 doped PANI; G) 1 M H_2SO_4 doped PANI; H) 1.5 M H_2SO_4 doped PANI; I) 2 M H_2SO_4 doped PANI and J) 2.5 M H_2SO_4 doped PANI. Reprinted from Materials Chemistry and Physics, 173, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Milenkovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z. "High yield and facile microwave-

- assisted synthesis of conductive H_2SO_4 doped polyanilines”, 255-261, Copyright (2016), with permission from Elsevier. 261
- Fig. 7-14 FTIR MW HCl doped PANI samples prepared at 8 W power with duration of 10 min. A) 0.5 M HCl doped PANI; B) 1 M HCl doped PANI; C) 1.5 M HCl doped PANI; D) 2 M HCl doped PANI; E) 2.5 M HCl doped PANI and F) 3 M HCl doped PANI. FTIR EMS HCl doped PANI samples prepared at 93W power with duration of 10 min. G) 0.5 M HCl doped PANI; H) 1 M HCl doped PANI; I) 1.5 M HCl doped PANI; J) 2 M HCl doped PANI; K) 2.5 M HCl doped PANI and L) 3 M HCl doped PANI. Reprinted from Current Applied Physics, 114, Jevremovic, M.; Zujovic, Z.; Stanisavljev, D. R.; Bowmaker, G. A. and Gizdavic-Nikolaidis, M. “Investigation of the effect of acid dopant on the physical properties of polyaniline prepared using microwave irradiation”, 1201-1207, Copyright (2014), with permission from Elsevier..... 263
- Fig. 7-15 SEM micrographs of the products obtained with CH_3COOH (red) and NH_4OH (blue) at different reaction times and power levels (CS = 0 W). Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z. “Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. 267
- Fig. 7-16 FTIR spectra of the products obtained with CH_3COOH (10 min) and NH_4OH (20 min) at different microwave powers. Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z. “Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. 269
- Fig. 7-17 Raman spectra of the PANIs obtained with CH_3COOH (10 min) and NH_4OH (20 min) at different microwave powers. Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z. “Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. 270
- Fig. 7-18 SS NMR spectra of the products obtained with CH_3COOH (10 min) and NH_4OH (20 min) at different microwave powers. Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic,

- Z. “Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. 272
- Fig. 7-19 XRD patterns of the PANI samples prepared with CH_3COOH and NH_4OH collected at different power levels and reaction times. Reprinted from Express Polymer Letters, 8, Gizdavic-Nikolaidis, M.; Jevremovic, M.; Allison, M. C.; Stanisavljev, D. R.; Bowmaker, G. A. and Zujovic, Z. “Self-assembly of nanostructures obtained in a microwave-assisted oxidative polymerization of aniline”, 745-755, Copyright (2014), with permission from Express Polymer Letters. . 274
- Fig. 7-20 SEM of the pure C_{60} sample obtained after sonication (A and B) and MW nanocomposite product with 10 wt% C_{60} (C and D). Note the nanostructured PANI formed on the surface of C_{60} blocks (C and D). Reprinted from Synthetic Metals, 217, Gizdavic-Nikolaidis, M.; Vella, J.; Bowmaker, G. A. and Zujovic, Z. D. “Rapid microwave synthesis of polyaniline– C_{60} nanocomposites”, 14-18, Copyright (2016), with permission from Elsevier. 277
- Fig. 7-21 TEM of the pure C_{60} sample obtained after sonication (A and B) and MW nanocomposite product with 10 wt% C_{60} (C; the C_{60} particles are indicated by arrows). Reprinted from Synthetic Metals, 217, Gizdavic-Nikolaidis, M.; Vella, J.; Bowmaker, G. A. and Zujovic, Z. D. “Rapid microwave synthesis of polyaniline– C_{60} nanocomposites”, 14-18, Copyright (2016), with permission from Elsevier. 277

LIST OF TABLES

Table 1-1 The experimental vibrational frequencies in the Raman spectrum (785 nm excitation) of EB-PANI and their assignments [19].....	15
Table 1-2 The experimental vibrational frequencies in the Raman spectrum (488 nm excitation) of EB-PANI and their assignments [19].....	16
Table 1-3 The amount (n) of the standard $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ sample and the second integral (I) of the EPR spectrum of the standard.....	19
Table 1-4 Parameters from EPR spectra of R-PANI, EB-PANI and acetone extract.....	20
Table 1-5 Assignment of the peaks in the CP MAS spectrum of EB-PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., "Iodine vapour doped polyaniline", 3070-3075, Copyright (2008), with permission from Elsevier.....	24
Table 1-6 Spin numbers (n_0) for different HCl doped PANI and EB-PANI samples.....	31
Table 1-7 Elemental analysis of PANI samples treated with HCl solutions of various concentrations and percent doping level of PANI by aqueous HCl.....	32
Table 1-8 Conductivity results for different HCl doped PANI samples... 36	36
Table 1-9 Parameters for calculation of the doping level of iodine in PANI. Reprinted from Polymer, 49 (13-14), Gizdavic-Nikolaidis, M. and Bowmaker, G. A., "Iodine vapour doped polyaniline", 3070-3075, Copyright (2008), with permission from Elsevier.....	40
Table 2-1 Absorption maxima for 0.05 g L ⁻¹ solutions of 3EABPANI and 3ABAPANI 1:1 EB forms in various solvents. Reprinted from Journal of Polymer Science Part A: Polymer Chemistry journal, 48, Gizdavic-Nikolaidis, M. R.; Zujovic, Z. D.; Ray, S.; Eastal, A. J. and Bowmaker, G. A., "Chemical synthesis of poly(aniline-co-ethyl-3-aminobenzoate) copolymers", 1339-1347, Copyright (2010), with permission from John Wiley and Sons.....	58
Table 4-1 Summary of the peak positions, peak widths (FWHM) and uncorrected peak areas in XPS spectra PANI-DPPH. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., "Solid-state	

NMR study of ^{15}N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier.	137
Table 4-2 $T_{1\rho}^H$, T_{IS} and corrected areas for the samples of EB-PANI and EB-PANI-DPPH, obtained from ^{15}N variable contact time experiments. Reprinted from Polymer, 47, Zujovic, Z. D.; Gizdavic-Nikolaidis, M.; Kilmartin P. A.; Idriss, H.; Senanayake, S. D. And Bowmaker, G. A., “Solid-state NMR study of ^{15}N labelled polyaniline upon reaction with DPPH”, 1166-1171, Copyright (2006), with permission from Elsevier.	151
Table 4-3 Antioxidant efficacy of 2ABAPANI and 2SULFOPANI synthesised by MW. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D. Microwave-Assisted Synthesis of Functionalised Polyaniline Nanostructures with Advanced Antioxidant Properties <i>J. Phys. Chem. C</i> 2010, 114, 18790-18796. Copyright (2010) American Chemical Society.	156
Table 5-1 Mean nanofibre diameter range (d), apparent compressive strength (CS), conductivity (σ) and contact angle (θ) of PLA and 3ABAPANI-PLA nanofibrous mats. Reprinted from Macromolecular Bioscience, 10, Gizdavic-Nikolaidis, M. R.; Ray, S.; Bennett, J.; Easteal, A. J. and Cooney, R. P. “Electrospun functionalised polyaniline copolymer-based nanofibres with potential application in tissue engineering”, 4902-4910, Copyright (2010), with permission from John Wiley and Sons.....	172
Table 6-1 MIC determination of resistant and antibiotic sensitive <i>E. coli</i> , <i>P. aeruginosa</i> and <i>S. aureus</i> upon exposure to PANI and ABAPANI in ES and EB forms. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Easteal, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier.	195
Table 6-2 MIC determination of <i>E. coli</i> , <i>P. aeruginosa</i> and <i>S. aureus</i> upon exposure to fPANI. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Easteal, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier.	196
Table 6-3 MIC determination of Gram-positive and Gram-negative bacteria upon exposure to fPANI. Reprinted from Acta Biomaterialia, 7, Gizdavic-Nikolaidis, M.; Bennett, J.; Swift, S.; Easteal, A. J. and Ambrose, M., “Broad-spectrum Antimicrobial Activity of	

Functionalised Polyanilines”, 4204-4209, Copyright (2011), with permission from Elsevier.	197
Table 7-1 Yield of the fPANI samples obtained under conventional (CS) and microwave (MW) synthesis. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Stanisavljev, D. R.; Easteal, A. J.; Zujovic, Z. D. Microwave-Assisted Synthesis of Functionalised Polyaniline Nanostructures with Advanced Antioxidant Properties <i>J. Phys. Chem. C</i> 2010, <i>114</i> , 18790-18796. Copyright (2010) American Chemical Society.	239
Table 7-2 Yield of the EMS and CS synthesised PANI samples, using KIO ₃ as the oxidising agent, as a function of microwave irradiation power level. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation <i>J. Phys. Chem. C</i> 2012, <i>116</i> , 3235-3241. Copyright (2012) American Chemical Society.	249
Table 7-3 Molecular weight of the MW synthesised PANI samples using KIO ₃ and APS as oxidising agent in dependence of the MW power. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation <i>J. Phys. Chem. C</i> 2012, <i>116</i> , 3235-3241. Copyright (2012) American Chemical Society.	250
Table 7-4 The quinonoid/benzenoid ratios obtained from UV-Vis spectra of the EMS and CS synthesised PANI samples obtained at different microwave irradiation power levels [99]. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation <i>J. Phys. Chem. C</i> 2012, <i>116</i> , 3235-3241. Copyright (2012) American Chemical Society.	255
Table 7-5 Results for electrical conductivity for the EMS and CS synthesised PANI samples using KIO ₃ and APS as oxidising agent obtained at different microwave irradiation power levels. Reprinted with permission from Gizdavic-Nikolaidis, M. R.; Jevremovic, M.; Stanisavljev, D. R.; Zujovic, Z. D. Enhanced Microwave Synthesis: Fine-Tuning of Polyaniline Polymerisation <i>J. Phys. Chem. C</i> 2012, <i>116</i> , 3235-3241. Copyright (2012) American Chemical Society.	256

PREFACE

Electrically conducting polymers (CPs) are advanced materials which exhibit the electrical and optical properties of metals, whilst retaining the attractive mechanical properties and processing advantageous of polymers. These characteristics make CPs of great importance for fundamental science and offer possibilities for a wide variety applications in industry, *e.g.* as gas sensors, biosensors, actuators/artificial muscles, materials for anticorrosive coatings, and electronic devices. This is one area of polymer science that has probably seen the most dramatic advances recently.

This book is intended to provide an overview of the latest research developments and new techniques for preparation of polyanilines (PANI) and to offer the unique opportunity for readers in one place to explore exciting recent developments in applied research on nanostructured PANIs and functionalised polyanilines (fPANIs). The book is written for a wider scientific/industry readership: scholars, researchers, technologists, and students at all academic levels concerned with CPs and the exciting world of their applications.

The first chapter presents a concise introduction to PANI: its structure, charge storage, mechanism of conduction and standard methods of synthesis. The second chapter is dedicated to fPANIs. The competitive advantages of using PANI based CP include their facile and inexpensive synthesis, thermal stability to up to 300 °C, and their non-leaching property. The use of PANI for industrial applications is, however, often limited because of its insolubility in common solvents, thereby making it difficult to process. The insolubility of PANI can be circumvented to some extent, by copolymerising aniline with substituted anilines that impart solubility to the resulting fPANI. fPANIs are soluble in basic aqueous media, and in polar solvents such as *N*-methyl-2-pyrrolidone (NMP) and dimethyl sulfoxide (DMSO).

Nanofibres of PANI in particular have attracted great interest because of their properties which may enable them to find applications in sensors, batteries, molecular electronic devices, and as corrosion inhibitors and separation membranes. While various synthesis methods have been established, preparation of one-dimensional nanostructured PANI with controllable sizes and morphologies on a large scale is still a major challenge. Therefore, the third chapter deals with the synthesis of PANI with specific nanostructured morphologies. An overview of formation