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APPENDICES

Appendix A Effect of Plasma Treatment Time on Contact Angle Measurement

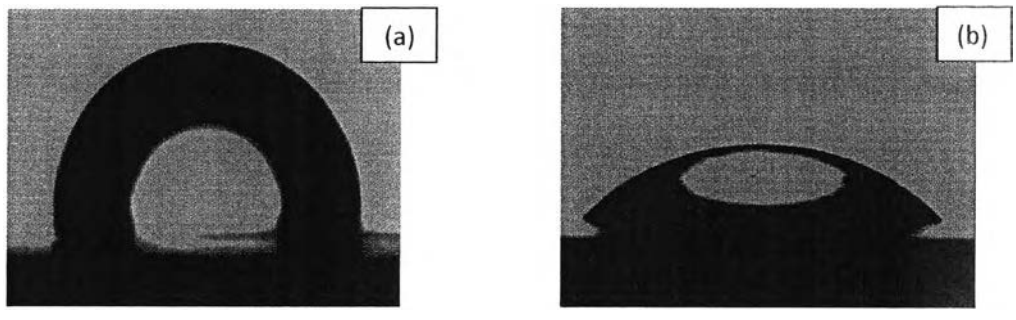

Figure A1 Water contact angle images of polypropylene films (a) before and (b) after DBD plasma treatment for 10 s.

Table A1 Effect of DBD plasma treatment time on water contact angle values of polypropylene films

Time of plasma treatment (s)	Contact angle value (θ)
0	89.7667±4.3301
5	55.0111± 1.4112
10	50.4111± 1.4112
20	50.5111± 5.7675
30	48.2556± 5.4806
40	47.7889± 5.6119
50	48.9778± 2.0004
60	47.6111± 3.8765
90	47.7889± 4.0003
120	48.7111± 5.5614

Appendix B Effect of Plasma Treatment Time on The Mechanical Properties

Table B1 Effect of plasma treatment time on mechanical properties of polypropylene films

Time of plasma treatment (s)	Tensile strength (MPa)	Elongation at break (%)
0	53.5069± 9.1179	1459.6333± 213.5583
10	55.8182± 2.3122	1712.2396± 137.8267
20	57.9559± 4.1521	1631.1890± 86.4012
30	53.1866± 1.5989	1508.0435± 88.1405
40	57.7298± 4.5436	1689.1664± 130.8853
50	53.7319± 4.5762	1417.5407± 166.3456
60	46.4510± 2.0954	1299.8128± 129.5687
90	53.1465± 5.6143	1492.5061± 109.7643

Appendix C Effect of Plasma Treatment Time on Surface Roughness

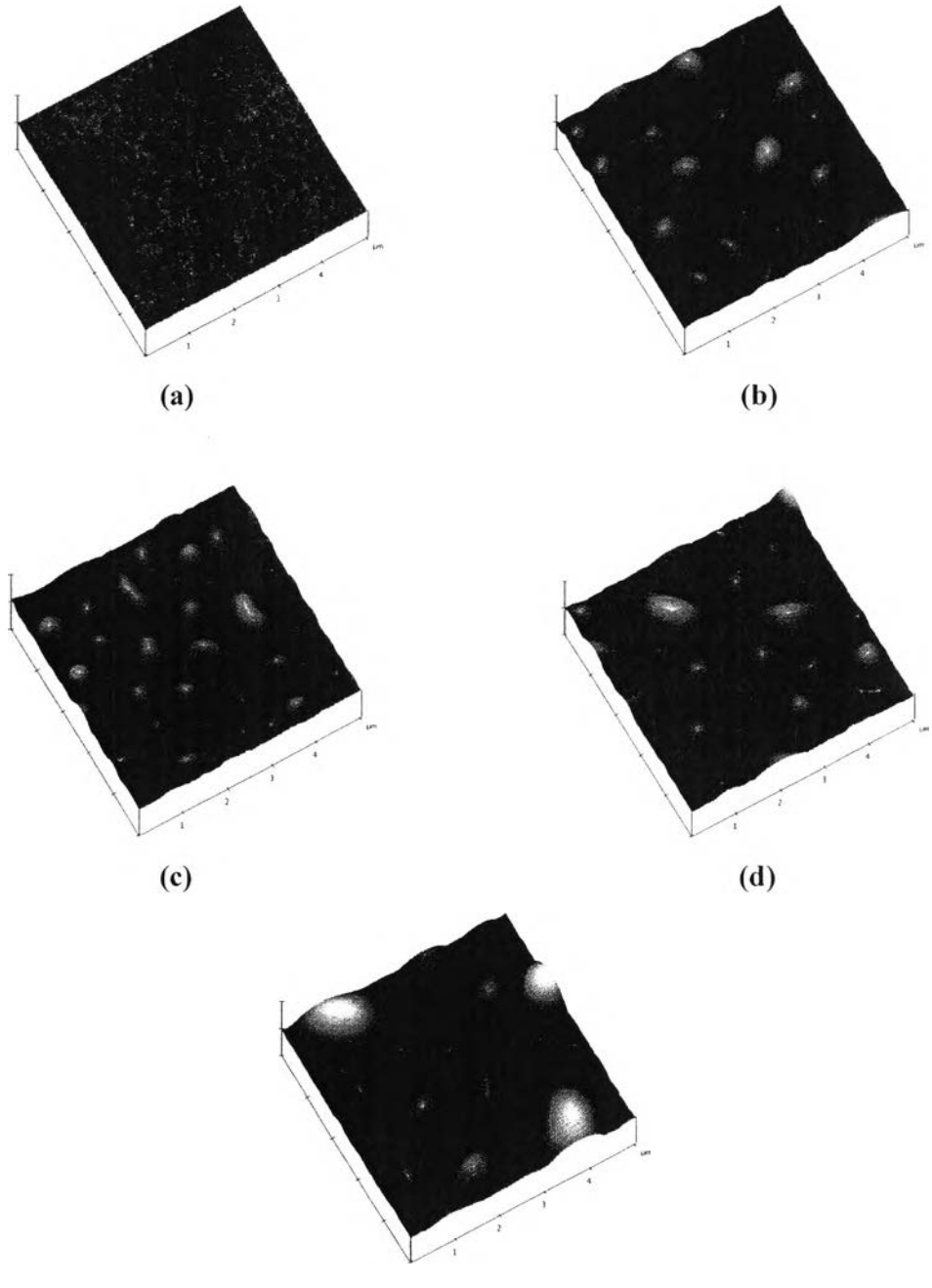

Figure C1 Three-dimentional views obtained with SPA scans of the PP sample, where (a) is untreated films, (b) represents 10 s, (c) 20s, (d) 30 s and (e) 40 s treated time.

Table C1 Effect of plasma treatment time on R_{rms} values

Time of plasma treatment (s)	R_{rms} (nm)
0	3.6660± 0.3338
10	28.8993± 3.5272
20	29.2153± 2.1383
30	38.3293± 5.8976
40	59.2727±5.6684

Appendix D Effect of Plasma Treatment Time on Depositing Zinc Oxide

Table D1 Effect of plasma treatment time on amount of zinc oxide deposited on polypropylene films

Time of plasma treatment (s)	Amount of deposited zinc oxide (%wt.)
10	0.2577±0.0483
20	0.2720±0.0169
30	0.2409±0.0308
40	0.2383±0.0326
60	0.2150±0.0292
90	0.2137±0.0709

Appendix E Atomic Absorption Spectroscopy (AAS)

Table E1 Effect of the number of washing cycle on the amount of deposited zinc oxide (ZnO) on polypropylene films

Amount of deposited zinc oxide (%wt.)	Concentration of $Zn(NO_3)_2$ (M)			
	0.05	0.10	0.50	1.00
0 cycle	0.2512±0.0652	0.6682±0.0485	1.1223±0.3587	1.3986±0.8223
1 cycle	0.1243±0.0664	0.2350±0.0563	0.2577±0.0408	0.4351±0.0642
2 cycles	0.0945±0.0250	0.1839±0.0136	0.2642±0.0140	0.2681±0.0178
3 cycles	0.0748±0.0184	0.1826±0.00389	0.2603±0.0280	0.2681±0.0140
4 cycles	0.0686±0.0273	0.1800±0.0353	0.2486±0.0654	0.2577±0.0136
5 cycles	0.0168±0.008972	0.1684±0.0577	0.1722±0.0179	0.2305±0.002243

Table E2 Amount of deposited zinc oxide on polypropylene films with different concentrations of $Zn(NO_3)_2$

Concentration of $Zn(NO_3)_2$ (M)	Amount of deposited zinc oxide (%wt.)
0.00	0.0000± 0.0000
0.05	0.0945± 0.0250
0.10	0.1839± 0.0136
0.50	0.2655±0.0729
1.00	0.2681± 0.0178

Appendix F ZnO - coated DBD plasma-treated PP Film

Table F1 Effect of deposited ZnO on mechanical properties of polypropylene films

Concentration of $Zn(NO_3)_2$ (M)	Tensile strength (MPa)	Elongation at break (%)
0.05	52.0607± 4.9210	1364.6718± 95.8073
0.1	52.4016± 4.5445	1407.6117± 83.6546
0.5	52.3655± 5.9712	1355.6414± 206.0173

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1. Paisoonsin, S. and Rujiravanit, R. (2012, April 24) Preparation of Zinc Oxide-coated Polypropylene Film by DBD Plasma Treatment for Antibacterial Packaging Applications. Proceedings of the 3rd National Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 18th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

Presentations:

1. Paisoonsin, S. and Rujiravanit, R. (2011, August 24 -26) Surface Modification of Polypropylene (PP) Films by Dielectric Barrier Discharge (DBD) Plasma Technique for Oxygen Barrier Property Improvement. Paper presented at the 6thInternational Symposium in Science and Technology at Kansai University 2011, Osaka, Japan.
2. Paisoonsin, S. and Rujiravanit, R. (2012, January 11-13) Zinc Oxide Coating on Polypropylene Film Surface-Modified by Using DBD Plasma Technique for Antibacterial Property Improvement. Paper presented at the Pure and Applied Chemistry International Conference 2012, Chiang Mai, Thailand.
3. Paisoonsin, S. and Rujiravanit, R. (2012, April 24th) Preparation of Zinc Oxide-coated Polypropylene Film by DBD Plasma Treatment for Antibacterial Packaging Applications. Paper presented at the 3rd Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 18th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.