REFERENCES

An, X., Cao, C., & Zhu, H. (2007). Bio-inspired fabrication of ZnO nanorod arrays and their optical and photoresponse properties. Journal of Crystal Growth, 308(2), 340–347.

Applerot, G., Perkas, N., Amirian, G., Girshevitz, O., & Gedanken, A. (2009). Coating of glass with ZnO via ultrasonic irradiation and a study of its antibacterial properties. Applied Surface Science, 256S, S3–S8.

Arnold, M. S., Avouris, P., Pan, Z. W. & Wang, Z. L. (2003). Field-effect transistors based on single semiconducting oxide nanobelts, Journal of Physical Chemistry B, 107, 659–663.

Behnajady, M. A., Modirshahla, N., & Hamzavi, R. (2006). Kinetic study on photocatalytic degradation of C.I. acid yellow 23 by ZnO photocatalyst. Journal of Hazardous Materials, 133, 226–232.

Cao, X., Lan, X., Zhao, C., Shen, W., & Yao, D. (2008). Porous ZnS/ZnO microspheres prepared through the spontaneous organization of nanoparticles and their application as supports of holding CdTe quantum dots. Materials Research Bulletin, 43(5), 1135–1144.

Cornell, R. M. & Schwertmann, U. (2003). The Iron Oxides: Structure, Properties, Reactions, Occurrences and Uses. (2nd ed.). Weinheim: Wiley-VCH.

Czaja, W. K., Romanovicz, D., & Brown, R. M., (2004). Structural investigations of microbial cellulose produced in stationary and agitated culture. Cellulose, 11, 403–411.

Czaja, W. K., Young, D. J., Kawecki, M., & Brown, R. M. (2007). The future prospects of microbial cellulose in biomedical applications. Biomacromolecules, 8, 1–12.

Dubey, V., Saxena, C., Singh, L., Ramana, K. V., & Chauhan R. S. (2002) Pervaporation of binary water–ethanol mixtures through bacterial cellulose membrane. Separation and Purification Technology, 27, 163–171.

Genzer, J. & Efimenko, K. (2006). Recent developments in superhydrophobic surfaces and their relevance to marine fouling: a review, Biofouling, 22 (5), 339–360.

Grzegorczyn, S., & Ezak, A. (2007). Kinetics of concentration boundary layers buildup in the system consisted of microbial cellulose biomembrane and electrolyte solutions. Journal of Membrane Science, 304, 148–155.

Haes, A. J. & Van Duyne, R. P. (2003). Nanosensors Enable Portable Detectors for Environmental and Medical Applications. Laser Focus World, 39, 153–156.

Hu, W., Chen, S., Li, X., Shi, S., Shen, W., Zhang, X., & Wang, H. (2009). *In situ* synthesis of silver chloride nanoparticles into bacterial cellulose membranes. Materials Science and Engineering C, 29, 1216–1219.

Hu, W., Chen, S., Zhou, B., & Wang, H. (2010). Facile synthesis of ZnO nanoparticles based on bacterial cellulose. Materials Science and Engineering B, 170, 88–92.

Jia, Z., Yue, L., Zheng, Y., & Xu, Z. (2008). Rod-like zinc oxide constructed by nanoparticles: synthesis, characterization and optical properties. Materials Chemistry and Physics, 107(1), 137–141.

Jung, S., Oh, E., Lee, K., Yang, Y., Park, C., Park, W. & Jeong, S (2008). Sonochemical Preparation of Shape-Selective ZnO Nanostructures. Crystal growth & design, 8(1), 265–269.

Jonas, R., & Farah, L.F. (1998). Production and applications of microbial cellulose. Polymer Degradation and stability, 59, 101–106.

Jones, N., Ray, B., Ranjit, K.T. & Manna, A.C. (2008). Antibacterial activityof ZnO nanoparticle suspensions on a broad spectrum of microorganisms. Federation of European Microbiological Societies Microbiol Letter, 279, 71–76.

Kamel, S. (2007). Nanotechnology and its applications in lignocellulosic composites, a mini review. eXPRESS Polymer Letters, 1, 546–575.

Kickelbick, G. (2007). Hybrid Materials. Synthesis, Characterization, and Applications. Weinheim: Wiley-VCH Verlag GmbH & Co. KGaA.

Kim, J. S., Yoon, T. J., Yu, K. N., Kim, B. G., Park, S. J., Kim, H. W., Lee, K. H., Park, S. B., Lee, J. K., & Cho, M. H. (2005). Toxicity and tissue distribution of magnetic nanoparticlesin mice. Journal of Toxicological Sciences, 89, 338–347.

Klemm, D., Schumann, D., Udhardt, U., & Marsch, S. (2001). Bacterial synthesized cellulose-artificial blood vessels for microsurgery. Progress in Polymer Science, 26(9), 1561–1603.

Li, C., Fang, G., Liu, N., Ren, Y., Huang, H., & Zhao, X. (2008). Snowflake-like ZnO structures: self-assembled growth and characterization. Materials Letters, 62(12–13), 1761–1764.

Liu, J., Huang, X., Li, Y., Duan, J., & Ai, H. (2006) Large-scale synthesis of flower-like ZnO structures by a surfactant free and low-temperature process. Materials Chemistry and Physics, 98(2–3), 523–527.

Li, Q., Chen, S. L. & Jiang, W. C. (2007). Durability of nano ZnO antibacterial cotton fabric to sweat, Journal of Applied Polymer Science, 103, 412–416.

Li, X., Chen, S., Hu, W., Shi, S., Shen, W., Zhang, X. & Wang H. (2009). *In situ* synthesis of CdS nanoparticles on bacterial cellulose nanofibers. Carbohydrate Polymers, 76, 509–512.

Lu, Y., & Chou, K. (2008). A simple and effective route for the synthesis of nano-silver colloidal dispersions. Journal of the Chinese Institute of Chemical Engineers, 39, 673–678.

Magdassi, S., Bassa, A., Vinetsky, Y. & Kamyshny, A. (2003). Silver Nanoparticles as Pigments for Water-based Ink-Jet Inks. Chemistry of materials, 15, 2208–2217.

Majewski, P., & Thierry, B. (2007). Functionalized magnetite nanoparticles–synthesis, properties, and bio-applications. Critical Reviews in Solid State and Materials Science, 32, 203–215.

Maneerung, T., Tokura, S., & Rujiravanit, R. (2008). Impregnation of silver nanoparticles into bacterial cellulose for antimicrobial wound dressing. Carbohydrate Polymers, 72, 43–51.

Nakatsubo, F., Kamitakahara, H., & Hori, M. (1996). Cationic ring-opening polymerization of 3,6-d-O-benzyl-α-d-glucose 1,2,4-orthopivalate and the first chemical synthesis of cellulose. Journal of American Chemical Society, 118, 1677–1688.

Nie, S. & Emory, S. R. (1997). Probing Single Molecules and Single Nanoparticles by Surface-enhanced Raman Scattering. Science, 275, 1102–1106.

Pan, Z. W., Dai, Z. R. & Wang, Z. L. (2001). Nanobelts of semiconducting oxides, Science, 291, 1947–1949.

Pradhan, N., Pal, A., & Pal, T. (2002) Silver Nanoparticle Catalyzed Reduction of Aromatic Nitro Compounds. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 196(2), 247–257.

Rezaee, A., Solimani, S., & Forozandemogadam, M. (2005). Role of plasmid in production of *Acetobacter xylinum* biofilms. American Journal of Biochemistry and Biotechnology, 1, 121–125.

Small, A. C. & Johnston, J. H. (2009). Novel hybrid materials of magnetic nanoparticles and cellulose fibers. Journal of Colloid and Interface Science, 331, 122–126.

Sulieman, K. M., Huang, X., Liu, J., & Tang, M. (2007). Formation of ZnO three-side teethed nanostructures. Materials Letters, 61(8–9), 1756–1759.

Tarchevsky, I.A., & Marchenko, G.N. (1991). Cellulose: biosynthesis and structure. Berlin: Springer.

Tartaj, P., Morales, M. D., Veintemillas-Verdaguer, S., Gonzalez-Carreno, T., & Serna, C. J. (2003). The preparation of magnetic nanoparticles for applications in biomedicine. Journal of Physics D: Applied Physics, 36, R182–R197.

Tartaj, P., Morales, M. P., Gonzalez-Carreno, T., Veintemillas-Verdaguer, S., & Serna, C. J. (2005). Advances in magnetic nanoparticles for biotechnology applications. Journal of Magnetism and Magnetic Materials, 290–291, 28–34.

Teja, A. S., & Koh, P. (2009). Synthesis, properties, and applications of magnetic iron oxide nanoparticles. Progress in Crystal Growth and Characterization of Materials, 55, 22–45.

Tokoh, C., Takabe, K., Fujita, M., & Saiki, H. (1998). Cellulose synthesized by *Acetobacter Xylinum* in the presence of acetyl glucomannan. Cellulose, 5, 249–261.

Vandamme, E. J., De Baets, S., Vanbaelen, A., Joris, K., & De Wulf, P. (1997). Improved production of bacterial cellulose and its application potential. Polymer Degradation and Stability, 59, 93–99.

Vigneshwaran, N., Kumar, S., Kathe, A.A., Varadarajan, P.V. & Prasad, V. (2006). Functional finishing of cotton fabrics using zinc oxide–soluble starch nanocomposites, Nanotechnology, 17, 5087–5095.

Wan, Y., Hong, L., Jia, S., Huang, Y., Zhu, Y., Wang, Y., & Jiang, H. (2006). Synthesis and characterization of hydroxyapatite-bacterial cellulose nanocomposites. Composites Science and Technology, 66, 1825–1832.

Watanabe, K., Tabuchi, M., Morinaga, Y., & Yoshinaga, F. (1998). Structure features and properties of bacterial cellulose produced in agitated culture. Cellulose, 5, 187–200.

Wu, L., Wu, Y., & Lü, Y. (2006). Self-assembly of small ZnO nanoparticles toward flake-like single crystals. Materials Research Bulletin, 41(1), 128–133.

Xiong, M., Gu, G., You, B. & Wu, L. (2003). Preparation and characterization of poly(styrene butylacrylate) latex/nano-ZnO nanocomposites. Journal of Applied Polymer Science, 90, 1923–1931.

Xu, B. & Cai, Z. (2008). Fabrication of a superhydrophobic ZnO nanorod array film on cotton fabrics via a wet chemical route and hydrophobic modification, Applied Surface Science, 254, 5899–5904.

Xu, T. & Xie, C. S. (2003). Tetrapod-like nano-particle ZnO/acrylic resin composite and its multi-function property, Progress in Organic Coatings, 46, 297–301.

Yamanaka, S., Budhiono, A., & Iguchi, M. (2000). Review bacterial cellulose-a masterpiece of nature's arts. Journal of Materials Science, 35, 261–270.

Ye, L., Lai, Z., Liu, J., & Tholen, A. (1999). Effect of Ag Particle Size on Electrical Conductivity of Isotropically Conductive Adhesives. IEEE TRANSACTIONS on Electronics Packaging Manufacturing, 22 (4), 299–302.

Zhang, D., & Qi, L. (2005). Synthesis of mesoporous titania networks consisting of anatase nanowires by templating of bacterial cellulose membranes. Chemical Communications, 21, 2735–2737.

Zhang, R., Moon, K., Lin, W., Agar, J. C. & Wong, C. (2011). A simple, low-cost approach to prepare flexible highly conductive polymer composites by *in situ* reduction of silver carboxylate for flexible electronic applications. Composites Science and Technology, 71, 528–534.

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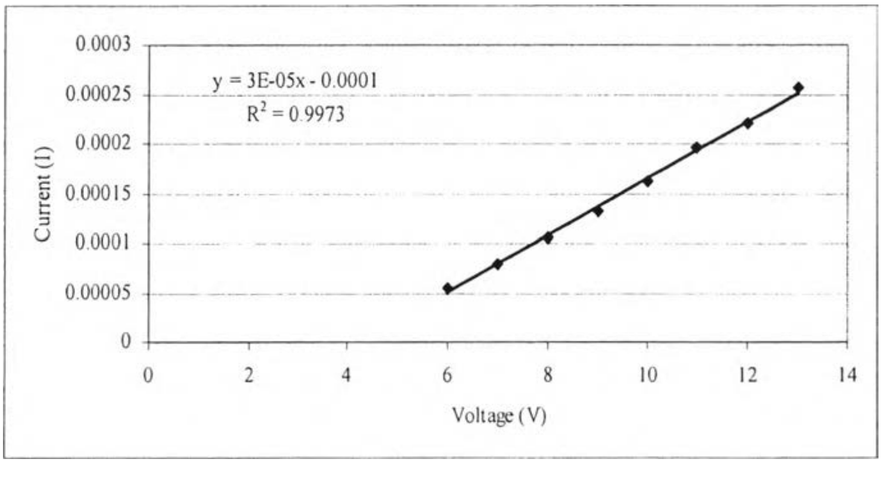
APPENDICES

Appendix A Electrical conductivity of as-prepared Ag particle incorporated-BC samples prepared by ammonia gas enhancing *in situ* synthesis method

Table A1 The ohmic regime of silicon wafer, at 27 °C, R.H. 55%

V			I			I, avg
1	2	3	1	2	3	
13	13	13	0.000256	2.56E-04	2.56E-04	2.56E-04
12	12	12	2.26E-04	0.000221	0.000214409	2.20E-04
11	11	11	1.96E-04	1.92E-04	0.000199054	1.96E-04
10	10	10	1.64E-04	0.000163	1.61E-04	1.63E-04
9	9	9	1.37E-04	0.00013	0.000127097	1.31E-04
8	8	8	1.07E-04	1.05E-04	0.000104924	1.06E-04
7	7	7	8.15E-05	7.91E-05	7.68E-05	7.91E-05
6	6	6	6.07E-05	5.26E-05	5.20E-05	5.51E-05



$K = I/V * \rho/t$

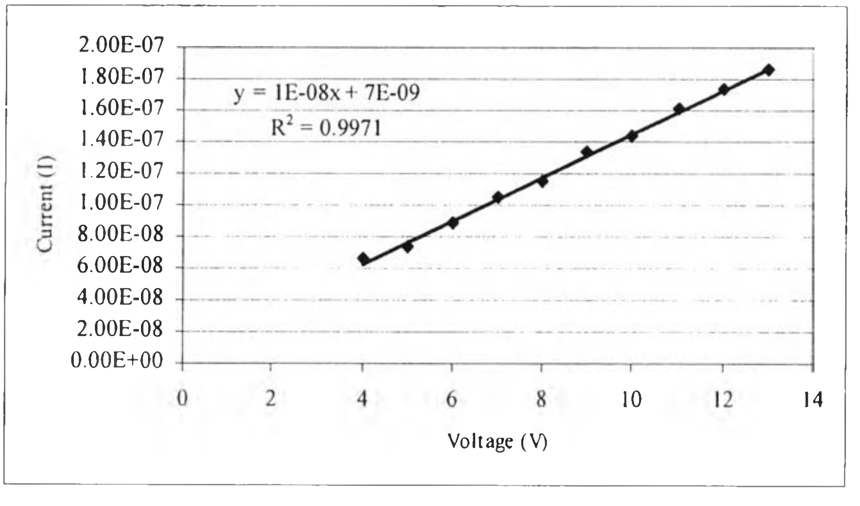
I/V = slope = 3.00E-05

ρ/t = 107.373

K = 3.00E-05*107.373 = 3.22E-03

Table A2 The ohmic regime of neat bacterial cellulose

V			I			I, avg
1	2	3	1	2	3	
13	13	13	1.88E-07	1.85E-07	1.85E-07	1.86E-07
12	12	12	1.73E-07	1.71E-07	1.75E-07	1.73E-07
11	11	11	1.61E-07	1.62E-07	1.61E-07	1.61E-07
10	10	10	1.46E-07	1.43E-07	1.41E-07	1.43E-07
9	9	9	1.31E-07	1.36E-07	1.35E-07	1.34E-07
8	8	8	1.11E-07	1.13E-07	1.21E-07	1.15E-07
7	7	7	1.04E-07	1.05E-07	1.08E-07	1.05E-07
6	6	6	8.98E-08	8.90E-08	8.71E-08	8.86E-08
5	5	5	6.96E-08	7.39E-08	7.73E-08	7.36E-08
4	4	4	6.48E-08	6.54E-08	6.73E-08	6.58E-08



Thickness (cm)			avg
0.0045	0.0055	0.0047	0.0049

K = 3.22E-03

Thickness (t) = 0.0049 cm

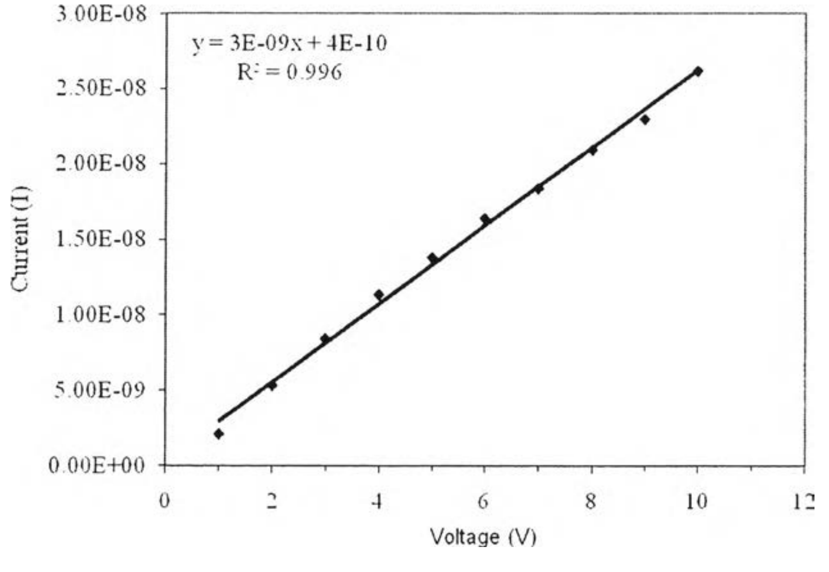
I/V (slope) = 1.00E-08

Specific conductivity (σ) = I/(V*K*t)

σ = 1.00E-08/(3.22E-03*0.0049) = 6.34E-04 S/cm

Table A3 The ohmic regime of Ag particle-incorporated BC (Sample 1-1)

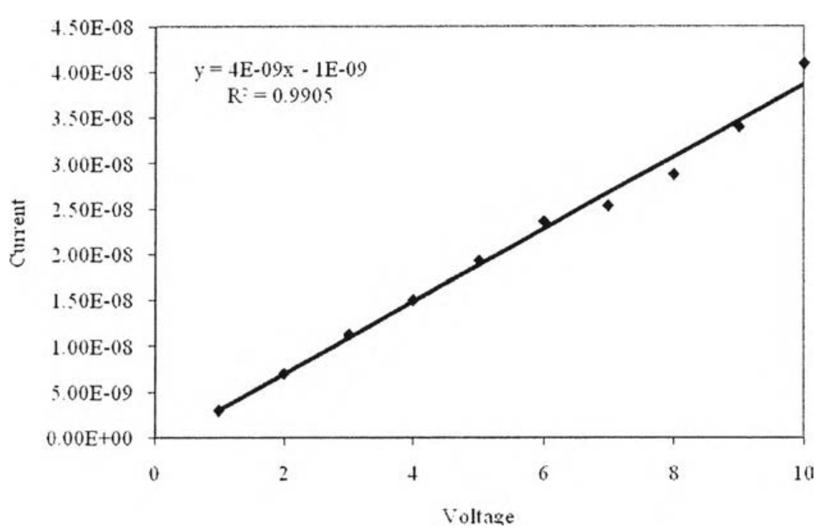
V			I			I, avg
1	2	3	1	2	3	
10	10	10	2.70E-08	2.6E-08	2.56E-08	2.62E-08
9	9	9	2.29E-08	2.29E-08	2.32E-08	2.30E-08
8	8	8	2.06E-08	2.10E-08	2.11E-08	2.09E-08
7	7	7	1.84E-08	1.83E-08	1.84E-08	1.84E-08
6	6	6	1.65E-08	1.64E-08	1.62E-08	1.64E-08
5	5	5	1.36E-08	1.37E-08	1.41E-08	1.38E-08
4	4	4	1.11E-08	1.15E-08	1.16E-08	1.14E-08
3	3	3	8.42E-09	8.42E-09	8.52E-09	8.46E-09
2	2	2	5.24E-09	5.40E-09	5.38E-09	5.34E-09
1	1	1	2.14E-09	2.10E-09	2.12E-09	2.12E-09



***I/V = slope = 3.00E-09**

Table A4 The ohmic regime of Ag particle-incorporated BC (Sample 1-2)

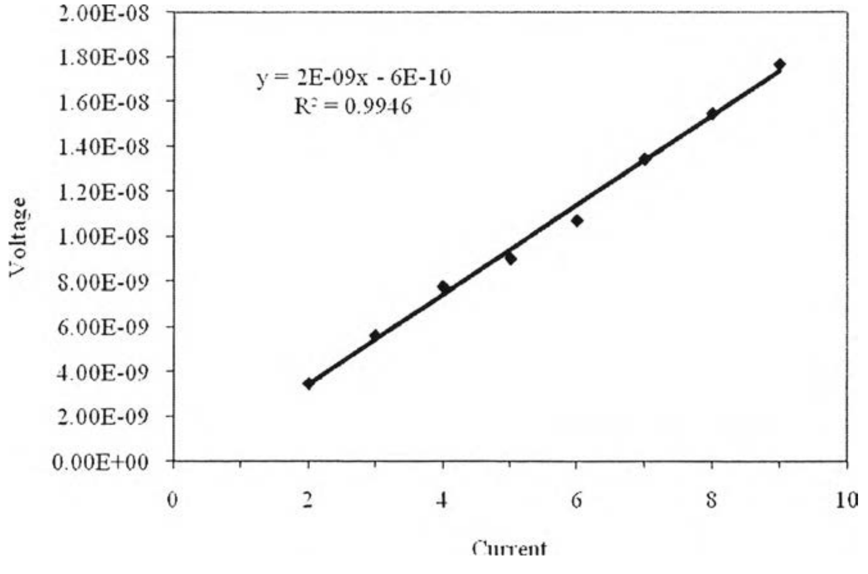
V			I			I, avg
1	2	3	1	2	3	
10	10	10	4.19E-08	4.12186E-08	3.98E-08	4.10E-08
9	9	9	3.45E-08	3.37E-08	3.39E-08	3.40E-08
8	8	8	2.89E-08	2.86E-08	2.90E-08	2.88E-08
7	7	7	2.47E-08	2.43E-08	2.70E-08	2.53E-08
6	6	6	2.37E-08	2.36E-08	2.36E-08	2.36E-08
5	5	5	1.97E-08	1.93E-08	1.89E-08	1.93E-08
4	4	4	1.51E-08	1.48E-08	1.51E-08	1.50E-08
3	3	3	1.13E-08	1.12E-08	1.13E-08	1.12E-08
2	2	2	7.04E-09	7.02E-09	6.89E-09	6.98E-09
1	1	1	2.92E-09	2.99E-09	2.92E-09	2.94E-09



***I/V = slope =4.00E-09**

Table A5 The ohmic regime of Ag particle-incorporated BC (Sample 1-3)

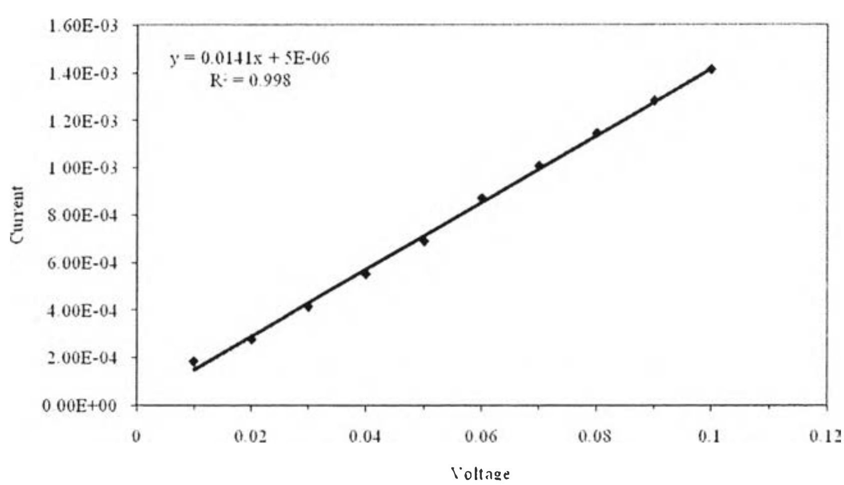
V			**I**			**I, avg**
1	**2**	**3**	**1**	**2**	**3**	
10	10	10	1.94E-08	2.02E-08	2.00E-08	1.99E-08
9	9	9	1.79E-08	1.74E-08	1.77E-08	1.77E-08
8	8	8	1.54E-08	1.53E-08	1.57E-08	1.55E-08
7	7	7	1.35E-08	1.33E-08	1.35E-08	1.35E-08
6	6	6	1.12E-08	1.07E-08	1.03E-08	1.07E-08
5	5	5	8.65E-09	9.04E-09	9.35E-09	9.01E-09
4	4	4	7.61E-09	7.84E-09	7.90E-09	7.78E-09
3	3	3	5.69E-09	5.61E-09	5.59E-09	5.63E-09
2	2	2	3.42E-09	3.51E-09	3.52E-09	3.48E-09
1	1	1	5.45E-10	5.78E-10	5.81E-10	5.68E-10



***I/V = slope =2.00E-09**

Table A6 The ohmic regime of Ag particle-incorporated BC (Sample 2-1)

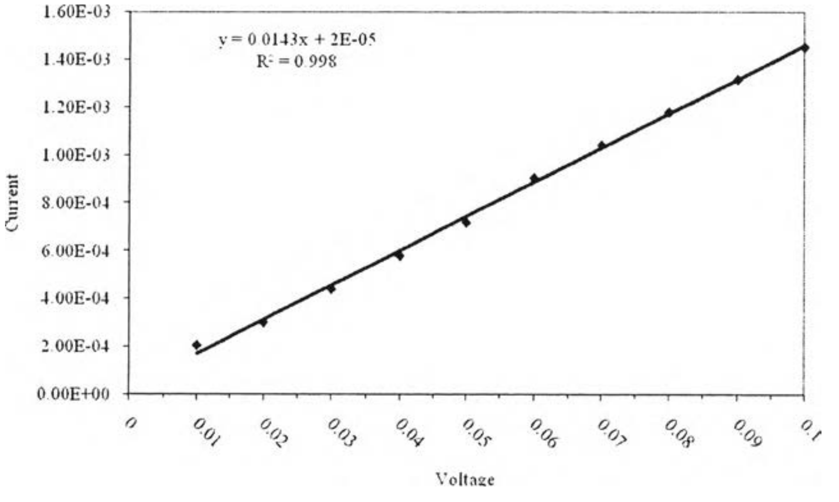
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0014092	1.41E-03	0.00141483	1.41E-03
0.09	0.09	0.09	0.0012803	0.00128234	0.00128304	1.28E-03
0.08	0.08	0.08	1.15E-03	0.00114485	0.0011447	1.14E-03
0.07	0.07	0.07	0.0010075	0.00100658	0.00100685	1.01E-03
0.06	0.06	0.06	8.71E-04	0.00087005	0.00087008	8.70E-04
0.05	0.05	0.05	6.87E-04	0.00068766	0.00068786	6.88E-04
0.04	0.04	0.04	0.0005505	0.00054964	0.00054998	5.50E-04
0.03	0.03	0.03	0.0004123	0.00041227	4.13E-04	4.13E-04
0.02	0.02	0.02	0.0002757	0.00027592	0.00027555	2.76E-04
0.01	0.01	0.01	0.0001833	1.83E-04	0.00018343	1.83E-04



***I/V = slope = 0.0141**

Table A7 The ohmic regime of Ag particle-incorporated BC (Sample 2-2)

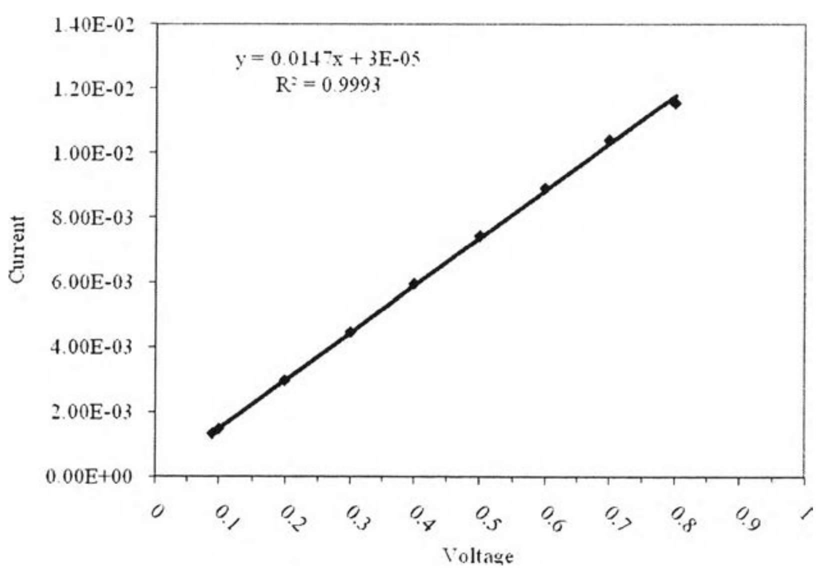
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0014505	1.45E-03	0.00145285	1.45E-03
0.09	0.09	0.09	0.0013147	0.00131607	0.00131649	1.32E-03
0.08	0.08	0.08	0.0011784	0.0011779	0.00117823	1.18E-03
0.07	0.07	0.07	0.0010394	0.00103993	0.00103931	1.04E-03
0.06	0.06	0.06	9.02E-04	0.00090214	0.00090241	9.02E-04
0.05	0.05	0.05	7.16E-04	0.00071527	0.00071577	7.16E-04
0.04	0.04	0.04	0.0005775	0.0005768	0.00057719	5.77E-04
0.03	0.03	0.03	0.000437	0.00043756	4.38E-04	4.37E-04
0.02	0.02	0.02	0.000299	0.00029809	0.00029888	2.99E-04
0.01	0.01	0.01	0.0002039	2.03E-04	0.00020331	2.04E-04



***I/V = slope =0.0143**

Table A8 The ohmic regime of Ag particle-incorporated BC (Sample 2-3)

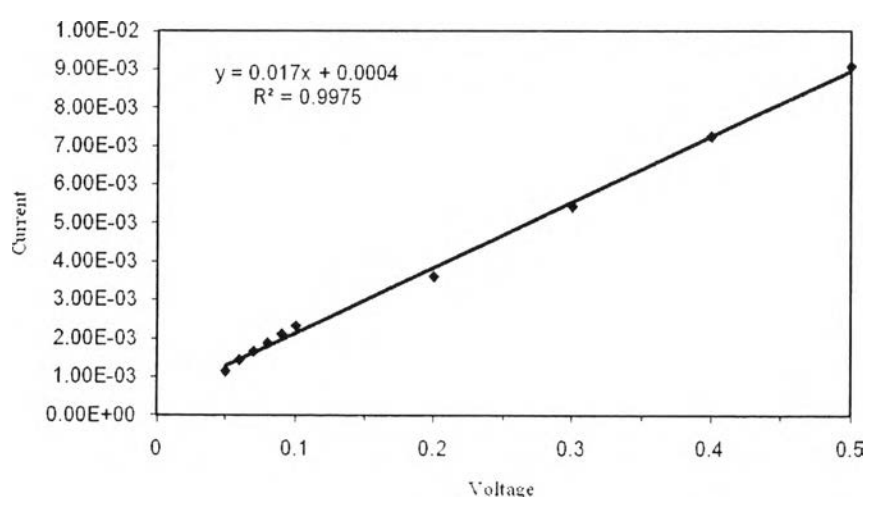
V			I			I, avg
1	2	3	1	2	3	
0.8	0.8	0.8	0.0115288	0.01152422	0.01162422	0.0115288
0.7	0.7	0.7	0.0104158	0.01041803	0.01041942	0.0104158
0.6	0.6	0.6	0.0089245	0.0089249	0.00892508	0.0089245
0.5	0.5	0.5	0.0074323	0.0074327	0.00743372	0.0074323
0.4	0.4	0.4	0.005942	0.00594163	0.00594214	0.005942
0.3	0.3	0.3	0.0044468	0.00444656	0.00444722	0.0044468
0.2	0.2	0.2	0.0029517	0.00295185	0.00295162	0.0029517
0.1	0.1	0.1	0.0014555	1.46E-03	0.00145566	0.0014555
0.09	0.09	0.09	0.0013146	0.00131449	0.00131515	0.0013146



***I/V = slope =0.0147**

Table A9 The ohmic regime of Ag particle-incorporated BC (Sample 3-1)

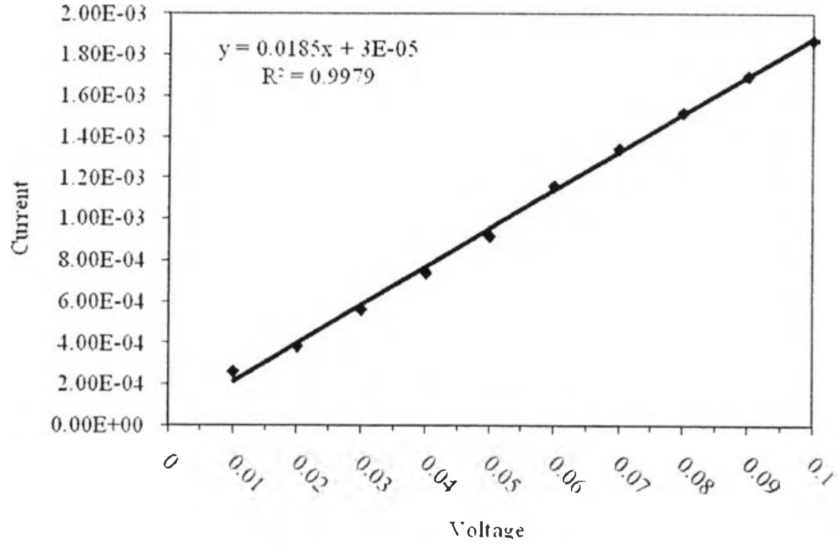
V			I			I, avg
1	2	3	1	2	3	
0.5	0.5	0.5	0.0090647	0.0090697	0.00907071	9.07E-03
0.4	0.4	0.4	0.0072481	0.00724695	0.00724699	7.25E-03
0.3	0.3	0.3	0.0054286	0.00542894	0.00542921	5.43E-03
0.2	0.2	0.2	0.0036087	0.00360747	0.00360715	3.61E-03
0.1	0.1	0.1	0.002332	2.33E-03	0.00233467	2.33E-03
0.09	0.09	0.09	0.002111	0.00211102	0.00211244	2.11E-03
0.08	0.08	0.08	0.0018758	0.0018818	0.00188358	1.88E-03
0.07	0.07	0.07	0.0016643	0.00166596	0.00166708	1.67E-03
0.06	0.06	0.06	1.44E-03	0.00144471	0.00144573	1.44E-03
0.05	0.05	0.05	1.15E-03	0.00114726	0.00114798	1.15E-03
0.5	0.5	0.5	0.0090647	0.0090697	0.00907071	9.07E-03



*I/V = slope = 0.017

Table A10 The ohmic regime of Ag particle-incorporated BC (Sample 3-2)

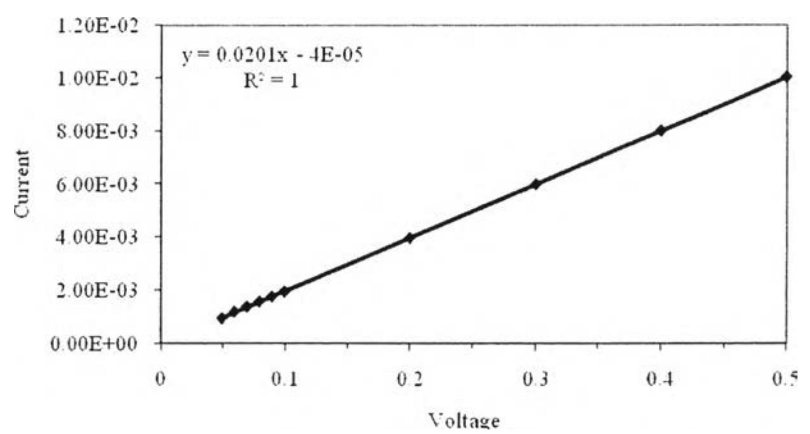
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0018715	1.87E-03	0.00187454	1.87E-03
0.09	0.09	0.09	0.001698	0.00169898	0.001699	1.70E-03
0.08	0.08	0.08	0.0015189	0.00152062	0.00151999	1.52E-03
0.07	0.07	0.07	0.001341	0.00134132	0.00134079	1.34E-03
0.06	0.06	0.06	1.16E-03	0.00115944	0.0011587	1.16E-03
0.05	0.05	0.05	9.18E-04	0.00091887	0.00091868	9.19E-04
0.04	0.04	0.04	0.0007411	0.00074033	0.00073944	7.40E-04
0.03	0.03	0.03	0.0005617	0.00056092	5.61E-04	5.61E-04
0.02	0.02	0.02	0.0003817	0.00038246	0.00038236	3.82E-04
0.01	0.01	0.01	0.0002606	2.61E-04	0.00026005	2.61E-04



***I/V = slope =0.0185**

Table A11 The ohmic regime of Ag particle-incorporated BC (Sample 3-3)

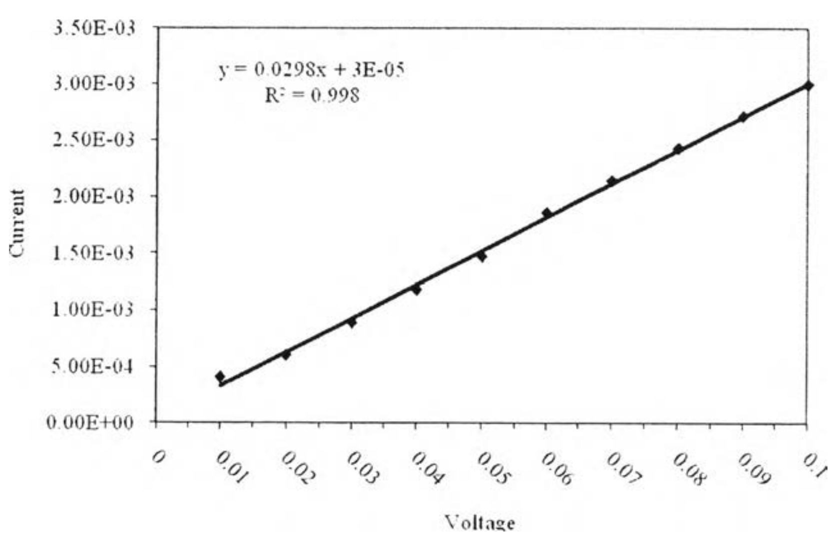
V			I			I, avg
1	2	3	1	2	3	
0.5	0.5	0.5	0.0098001	0.01010867	0.01013904	1.00E-02
0.4	0.4	0.4	0.0078767	0.00806511	0.00805789	8.00E-03
0.3	0.3	0.3	0.0058995	0.0060144	0.00602067	5.98E-03
0.2	0.2	0.2	0.0039198	0.00398359	0.00398629	3.96E-03
0.1	0.1	0.1	0.0019167	1.96E-03	0.00196307	1.95E-03
0.09	0.09	0.09	0.0017499	0.00177055	0.00177125	1.76E-03
0.08	0.08	0.08	0.0015641	0.00157935	0.0015805	1.57E-03
0.07	0.07	0.07	0.001379	0.00138828	0.00138982	1.39E-03
0.06	0.06	0.06	1.19E-03	0.00119838	0.00119964	1.20E-03



***I/V = slope =0.0201**

Table A12 The ohmic regime of Ag particle-incorporated BC (Sample 4-1)

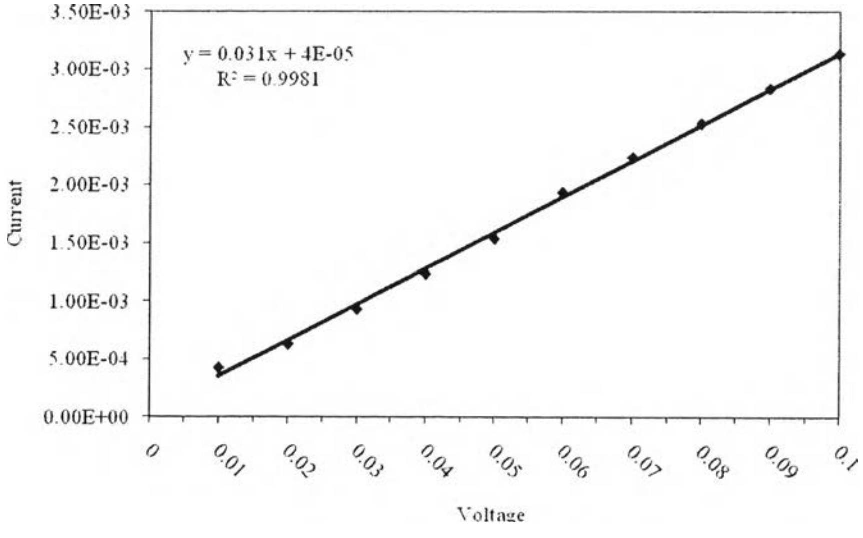
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0029981	3.00E-03	0.00300294	3.00E-03
0.09	0.09	0.09	0.0027183	0.00271805	0.00271869	2.72E-03
0.08	0.08	0.08	0.0024302	0.00242916	0.00242845	2.43E-03
0.07	0.07	0.07	0.0021407	0.00214178	0.00214064	2.14E-03
0.06	0.06	0.06	1.85E-03	0.00185575	0.0018554	1.86E-03
0.05	0.05	0.05	1.47E-03	0.00146818	0.00147003	1.47E-03
0.04	0.04	0.04	0.0011806	0.00118113	0.00117909	1.18E-03
0.03	0.03	0.03	0.0008902	0.00089176	8.90E-04	8.91E-04
0.02	0.02	0.02	0.000601	0.00060189	0.00060046	6.01E-04
0.01	0.01	0.01	0.0004056	4.06E-04	0.00040539	4.06E-04
0.1	0.1	0.1	0.0029981	3.00E-03	0.00300294	3.00E-03



***I/V = slope = 0.0298**

Table A13 The ohmic regime of Ag particle-incorporated BC (Sample 4-2)

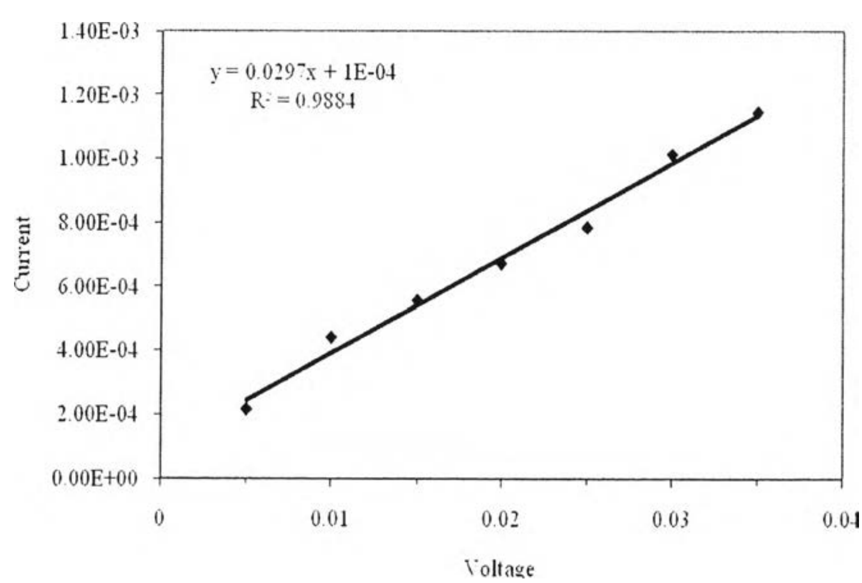
V			**I**			**I, avg**
1	**2**	**3**	**1**	**2**	**3**	
0.3	0.3	0.3	0.0095186	0.00951981	0.00952008	9.52E-03
0.2	0.2	0.2	0.0063258	0.00632615	0.00632703	6.33E-03
0.1	0.1	0.1	0.0031292	3.13E-03	0.00312911	3.13E-03
0.09	0.09	0.09	0.0028309	0.00283276	0.0028304	2.83E-03
0.08	0.08	0.08	0.002529	0.00252989	0.00253423	2.53E-03
0.07	0.07	0.07	0.0022352	0.00223596	0.00223706	2.24E-03
0.06	0.06	0.06	1.94E-03	0.00193615	0.00193664	1.94E-03
0.05	0.05	0.05	1.54E-03	0.00153458	0.00153548	1.54E-03
0.04	0.04	0.04	0.0012357	0.00123446	0.00123358	1.23E-03
0.03	0.03	0.03	0.0009323	9.32E-04	9.31E-04	9.32E-04



***I/V = slope =0.031**

Table A14 The ohmic regime of Ag particle-incorporated BC (Sample 4-3)

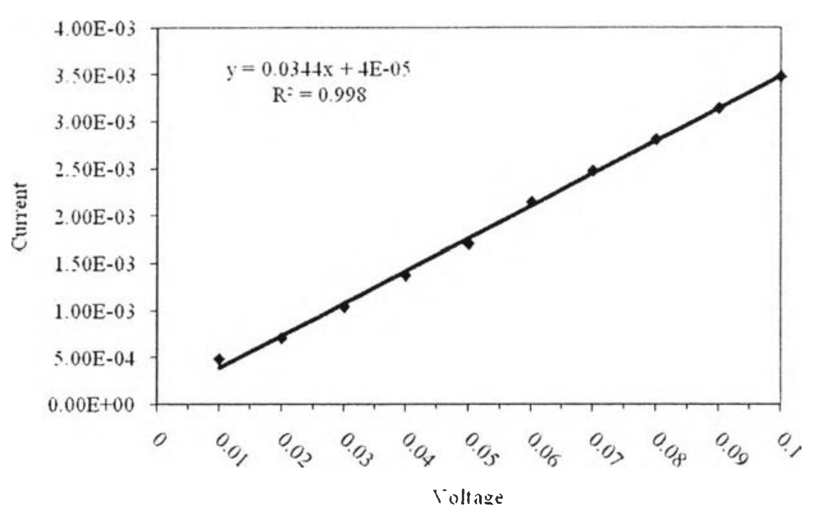
V			I			I, avg
1	2	3	1	2	3	
0.035	0.035	0.035	0.0011383	0.00114699	0.00115131	1.15E-03
0.03	0.03	0.03	0.0010149	0.00101383	1.01E-03	1.01E-03
0.025	0.025	0.025	0.000787	0.00078567	0.00078525	7.86E-04
0.02	0.02	0.02	0.0006738	0.00067314	0.00067135	6.73E-04
0.015	0.015	0.015	0.0005554	0.00055691	0.00055624	5.56E-04
0.01	0.01	0.01	0.0004409	4.42E-04	0.00044103	4.41E-04
0.005	0.005	0.005	0.0002156	0.00021515	0.00021679	2.16E-04



***I/V = slope =0.0297**

Table A15 The ohmic regime of Ag particle-incorporated BC (Sample 5-1)

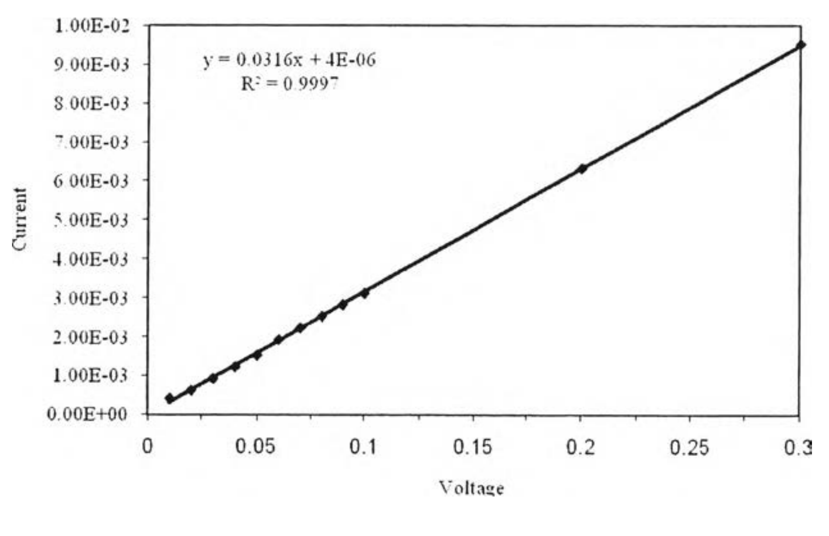
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0034787	3.48E-03	0.00347628	3.48E-03
0.09	0.09	0.09	0.0031433	0.00314136	0.00314073	3.14E-03
0.08	0.08	0.08	0.0028092	0.00280955	0.00281037	2.81E-03
0.07	0.07	0.07	0.0024763	0.00247674	0.00247806	2.48E-03
0.06	0.06	0.06	2.15E-03	0.002148	0.00214698	2.15E-03
0.05	0.05	0.05	1.70E-03	0.00170085	0.00170329	1.70E-03
0.04	0.04	0.04	0.0013709	0.00136885	0.00136998	1.37E-03
0.03	0.03	0.03	0.001037	0.00103858	1.04E-03	1.04E-03
0.02	0.02	0.02	0.0007038	0.00070397	0.00070363	7.04E-04



***I/V = slope =0.0344**

Table A16 The ohmic regime of Ag particle-incorporated BC (Sample 5-2)

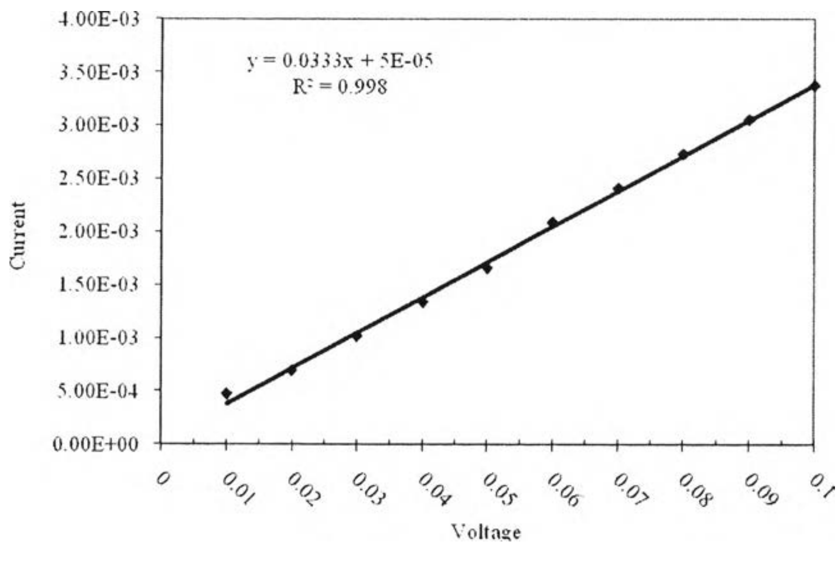
V			I			I, avg
1	2	3	1	2	3	
0.3	0.3	0.3	0.0095186	0.00951981	0.00952008	9.52E-03
0.2	0.2	0.2	0.0063258	0.00632615	0.00632703	6.33E-03
0.1	0.1	0.1	0.0031292	3.13E-03	0.00312911	3.13E-03
0.09	0.09	0.09	0.0028309	0.00283276	0.0028304	2.83E-03
0.08	0.08	0.08	0.002529	0.00252989	0.00253423	2.53E-03
0.07	0.07	0.07	0.0022352	0.00223596	0.00223706	2.24E-03
0.06	0.06	0.06	1.94E-03	0.00193615	0.00193664	1.94E-03
0.05	0.05	0.05	1.54E-03	0.00153458	0.00153548	1.54E-03
0.04	0.04	0.04	0.0012357	0.00123446	0.00123358	1.23E-03
0.03	0.03	0.03	0.0009323	9.32E-04	9.31E-04	9.32E-04
0.02	0.02	0.02	0.0006285	0.00063013	0.0006304	6.30E-04



***I/V = slope =0.0316**

Table A17 The ohmic regime of Ag particle-incorporated BC (Sample 5-3)

V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0033707	3.38E-03	0.00338096	3.38E-03
0.09	0.09	0.09	0.0030578	0.00305774	0.00305834	3.06E-03
0.08	0.08	0.08	0.0027345	0.00273456	0.00273505	2.73E-03
0.07	0.07	0.07	0.0024135	0.00241123	0.00241273	2.41E-03
0.06	0.06	0.06	2.09E-03	0.00209232	0.00209159	2.09E-03
0.05	0.05	0.05	1.66E-03	0.00165991	0.00166045	1.66E-03
0.04	0.04	0.04	0.0013382	0.00133613	0.00133582	1.34E-03
0.03	0.03	0.03	0.001014	1.01E-03	1.01E-03	1.01E-03
0.02	0.02	0.02	0.0006905	0.00069029	0.00069026	6.90E-04
0.01	0.01	0.01	0.0004698	4.70E-04	0.00046959	4.70E-04
0.1	0.1	0.1	0.0033707	3.38E-03	0.00338096	3.38E-03



***I/V = slope = 0.0333**

Table A18 The specific conductivity of Ag particle-incorporated BC

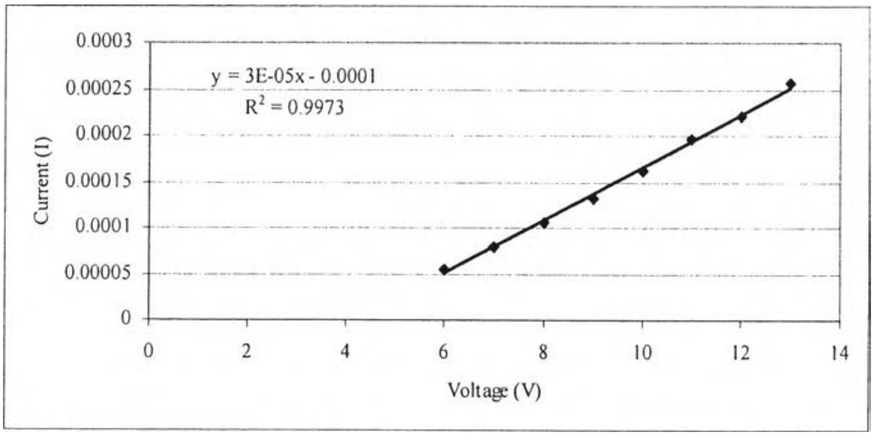
Sample reference	[$AgNO_3$] (M)	Slope(I/V)	Thickness, t (cm)	Electrical conductivity (S/cm)
1-1		3.00E-09	0.003450	0.000270051
1-2	0.010	4.00E-09	0.004050	0.000306725
1-3		2.00E-09	0.003075	0.000201990
2-1		0.0141	0.003450	1269.241156
2-2	0.025	0.0143	0.003600	1233.609386
2-3		0.0147	0.003400	1342.710997
3-1		0.0201	0.003350	1863.354037
3-2	0.050	0.0170	0.003300	1599.849426
3-3		0.0185	0.003600	1595.928226
4-1		0.0310	0.005075	1823.578007
4-2	0.075	0.0298	0.004400	2188.029362
4-3		0.0297	0.004775	1931.644499
5-1		0.0316	0.0046	2322.441264
5-2	0.100	0.0344	0.0047	2088.013744
5-3		0.0333	0.0048	2154.503106

Specific conductivity (σ) = I/(V×K×t); K= 3.22E-03

Appendix B Electrical conductivity of as-prepared magnetic and silver particle incorporated-BC samples

Table B1 The ohmic regime of silicon wafer, at 27 °C, R.H. 55%

V			I			I, avg
1	2	3	1	2	3	
13	13	13	0.000256	2.56E-04	2.56E-04	2.56E-04
12	12	12	2.26E-04	0.000221	0.000214409	2.20E-04
11	11	11	1.96E-04	1.92E-04	0.000199054	1.96E-04
10	10	10	1.64E-04	0.000163	1.61E-04	1.63E-04
9	9	9	1.37E-04	0.00013	0.000127097	1.31E-04
8	8	8	1.07E-04	1.05E-04	0.000104924	1.06E-04
7	7	7	8.15E-05	7.91E-05	7.68E-05	7.91E-05
6	6	6	6.07E-05	5.26E-05	5.20E-05	5.51E-05



$K = I/V * \rho/t$

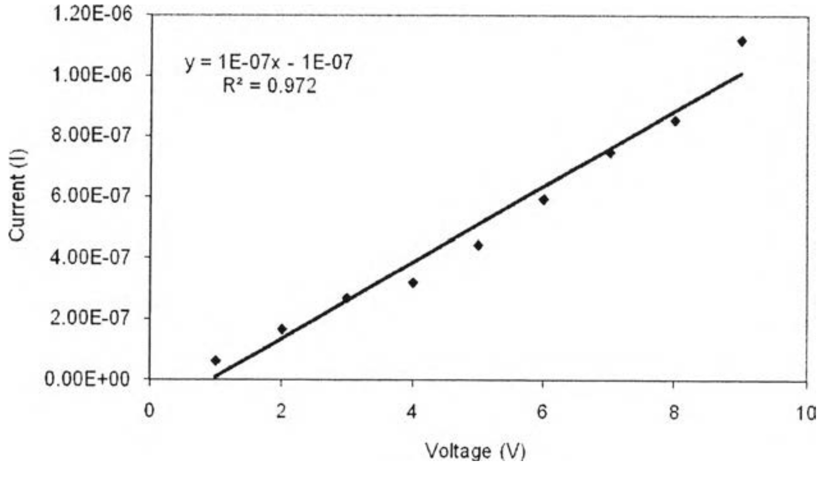
I/V = slope = 3.00E-05

ρ/t = 107.373

K = 3.00E-05*107.373 = 3.22E-03

Table B2 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.01 M of silver nitrate solution (sample 1-1)

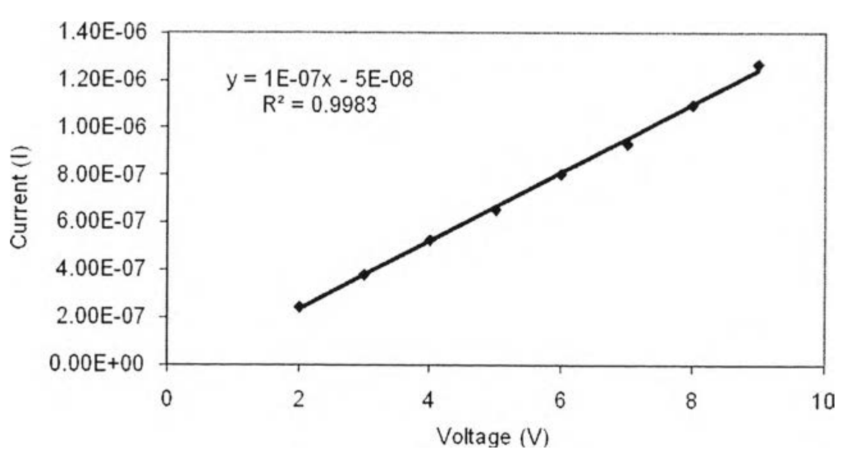
V			I			I, avg
1	2	3	1	2	3	
10	10	10	1.50E-06	1.3922E-06	1.30E-06	1.40E-06
9	9	9	1.12E-06	1.15E-06	1.10E-06	1.12E-06
8	8	8	8.72E-07	8.28E-07	8.65E-07	8.55E-07
7	7	7	7.39E-07	7.38E-07	7.69E-07	7.49E-07
6	6	6	6.09E-07	5.89E-07	5.84E-07	5.94E-07
5	5	5	4.66E-07	4.44E-07	4.23E-07	4.44E-07
4	4	4	3.13E-07	3.23E-07	3.29E-07	3.22E-07
3	3	3	2.46E-07	2.52E-07	3.12E-07	2.70E-07
2	2	2	1.58E-07	1.65E-07	1.8028E-07	1.68E-07
1	1	1	6.09E-08	6.61E-08	6.58E-08	6.43E-08



*I/V = slope = 1.00E-07

Table B3 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.01 M of silver nitrate solution (sample 1-2)

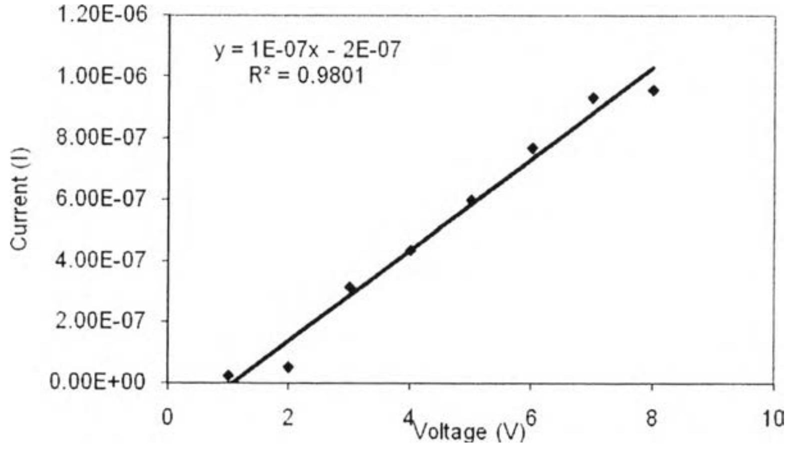
V			I			I, avg
1	2	3	1	2	3	
10	10	10	1.62E-06	1.55E-06	1.46E-06	1.55E-06
9	9	9	1.31E-06	1.25E-06	1.26E-06	1.27E-06
8	8	8	1.10E-06	1.10E-06	1.09E-06	1.10E-06
7	7	7	9.37E-07	9.35E-07	9.28E-07	9.34E-07
6	6	6	8.00E-07	8.07E-07	8.11E-07	8.06E-07
5	5	5	6.64E-07	6.51E-07	6.51E-07	6.56E-07
4	4	4	5.29E-07	5.31E-07	5.25E-07	5.28E-07
3	3	3	3.86E-07	3.79E-07	3.79E-07	3.81E-07
2	2	2	2.44E-07	2.44E-07	2.47E-07	2.45E-07
1	1	1	9.38E-08	9.21E-08	9.34E-08	9.31E-08



$*I/V$ = slope =1.00E-07

Table B4 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.01 M of silver nitrate solution (sample 1-3)

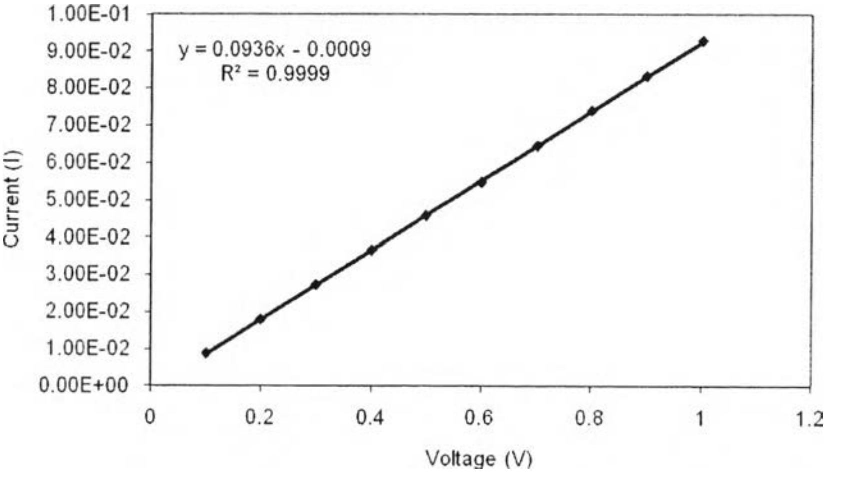
V			I			I, avg
1	2	3	1	2	3	
8	8	8	9.20E-07	9.89E-07	9.62E-07	9.57E-07
7	7	7	9.40E-07	9.35E-07	9.22E-07	9.33E-07
6	6	6	7.88E-07	7.66E-07	7.50E-07	7.68E-07
5	5	5	6.18E-07	6.00E-07	5.76E-07	5.98E-07
4	4	4	4.45E-07	4.37E-07	4.22E-07	4.35E-07
3	3	3	3.21E-07	3.13E-07	3.07E-07	3.13E-07
2	2	2	5.18E-08	5.11E-08	5.01E-08	5.10E-08
1	1	1	2.34E-08	2.17E-08	2.24E-08	2.25E-08



***I/V = slope =1.00E-07**

Table B5 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.05 M of silver nitrate solution (sample 2-1)

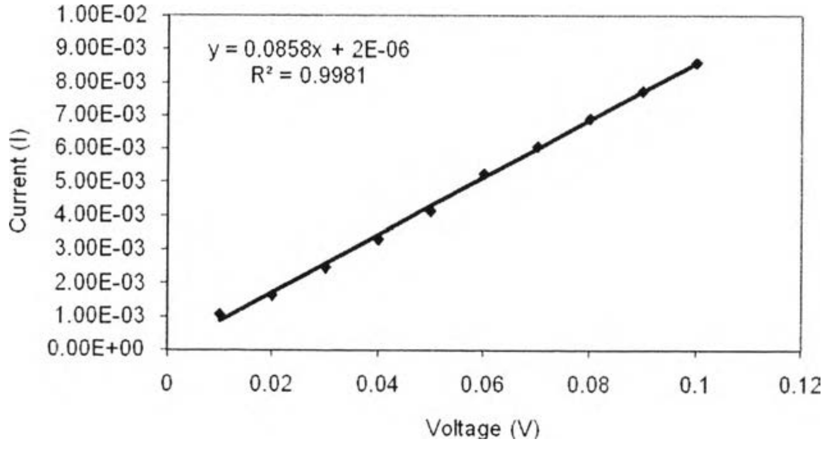
V			I			I, avg
1	2	3	1	2	3	
1	1	1	9.24E-02	9.30E-02	9.34E-02	9.29E-02
0.9	0.9	0.9	0.0833865	0.08330624	0.08352977	8.34E-02
0.8	0.8	0.8	0.0739884	0.07398032	0.07428592	7.41E-02
0.7	0.7	0.7	0.0649628	0.06499186	0.06381696	6.46E-02
0.6	0.6	0.6	0.0545478	0.05483567	0.05489631	5.48E-02
0.5	0.5	0.5	0.0457487	0.04571353	0.0457225	4.57E-02
0.4	0.4	0.4	0.0364881	0.03649173	0.03649907	3.65E-02
0.3	0.3	0.3	0.0272995	0.02726175	0.0272195	2.73E-02
0.2	0.2	0.2	0.0180295	0.01791418	0.01773297	1.79E-02
0.1	0.1	0.1	0.0087266	8.64E-03	0.00863279	8.67E-03



***I/V = slope = 0.0936**

Table B6 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.05 M of silver nitrate solution (sample 2-2)

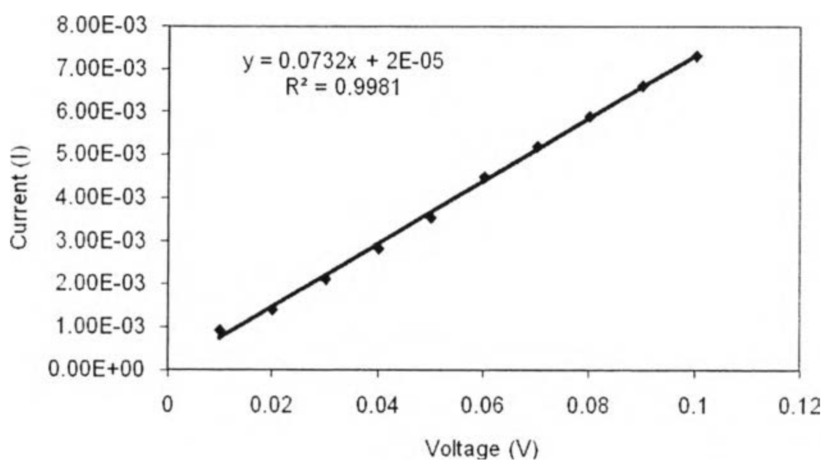
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0086171	8.56E-03	0.00855487	8.58E-03
0.09	0.09	0.09	0.0077284	0.00772629	0.00773319	7.73E-03
0.08	0.08	0.08	6.90E-03	0.00690243	0.00690207	6.90E-03
0.07	0.07	0.07	0.0060715	0.00606777	0.00606789	6.07E-03
0.06	0.06	0.06	5.24E-03	0.00524623	0.00524384	5.24E-03
0.05	0.05	0.05	4.14E-03	4.14E-03	0.00414108	4.14E-03
0.04	0.04	0.04	0.0033113	0.00331061	0.00331013	3.31E-03
0.03	0.03	0.03	0.0024791	0.00247641	2.48E-03	2.48E-03
0.02	0.02	0.02	0.0016495	0.00164822	0.00164802	1.65E-03
0.01	0.01	0.01	0.0010851	1.08E-03	0.00108162	1.08E-03



***I/V = slope =0.0858**

Table B7 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.050 M of silver nitrate solution (sample 2-3)

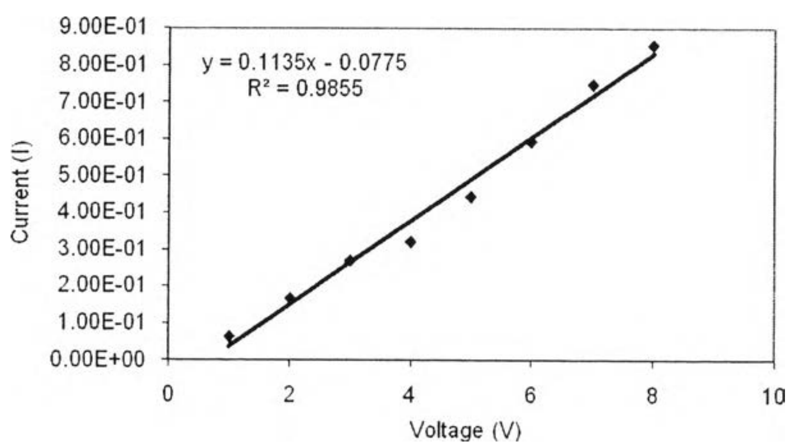
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0073074	7.32E-03	0.00732391	7.32E-03
0.09	0.09	0.09	0.0066216	0.00662315	0.00662267	6.62E-03
0.08	0.08	0.08	5.91E-03	0.0059107	0.00591232	5.91E-03
0.07	0.07	0.07	0.0052051	0.00520376	0.00520561	5.20E-03
0.06	0.06	0.06	4.50E-03	0.0044956	0.00449554	4.50E-03
0.05	0.05	0.05	3.55E-03	0.0035508	0.00356075	3.55E-03
0.04	0.04	0.04	0.0028451	0.00284369	0.00284566	2.84E-03
0.03	0.03	0.03	0.0021319	0.00213096	2.13E-03	2.13E-03
0.02	0.02	0.02	0.0014176	0.0014181	1.42E-03	1.42E-03
0.01	0.01	0.01	0.0009334	9.35E-04	0.00093111	9.33E-04



***I/V = slope =0.0732**

Table B8 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.100 M of silver nitrate solution (sample 3-1)

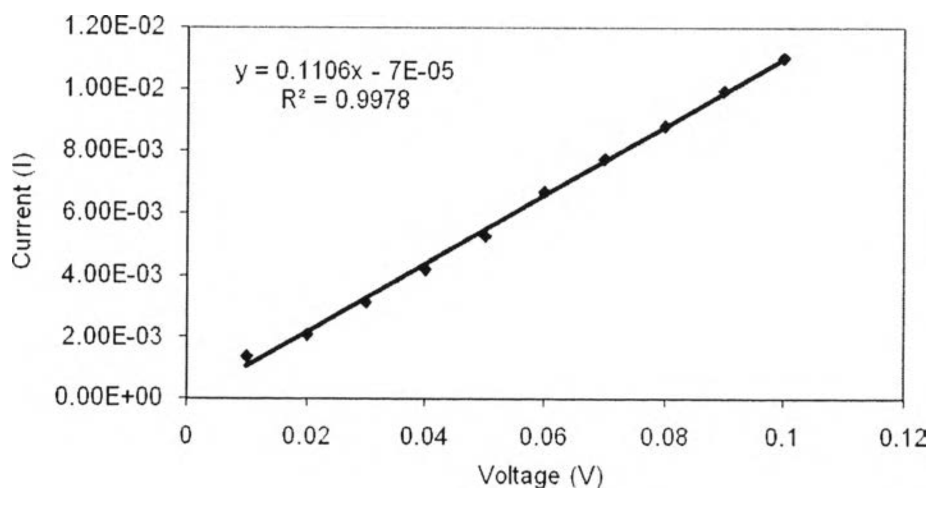
V			**I**			**I, avg**
1	**2**	**3**	**1**	**2**	**3**	
0.5	0.5	0.5	0.0090647	0.0090697	0.00907071	9.07E-03
0.4	0.4	0.4	0.0072481	0.00724695	0.00724699	7.25E-03
0.3	0.3	0.3	0.0054286	0.00542894	0.00542921	5.43E-03
0.2	0.2	0.2	0.0036087	0.00360747	0.00360715	3.61E-03
0.1	0.1	0.1	0.002332	2.33E-03	0.00233467	2.33E-03
0.09	0.09	0.09	0.002111	0.00211102	0.00211244	2.11E-03
0.08	0.08	0.08	0.0018758	0.0018818	0.00188358	1.88E-03
0.07	0.07	0.07	0.0016643	0.00166596	0.00166708	1.67E-03



***I/V = slope = 0.1135**

Table B9 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.100 M of silver nitrate solution (sample 3-2)

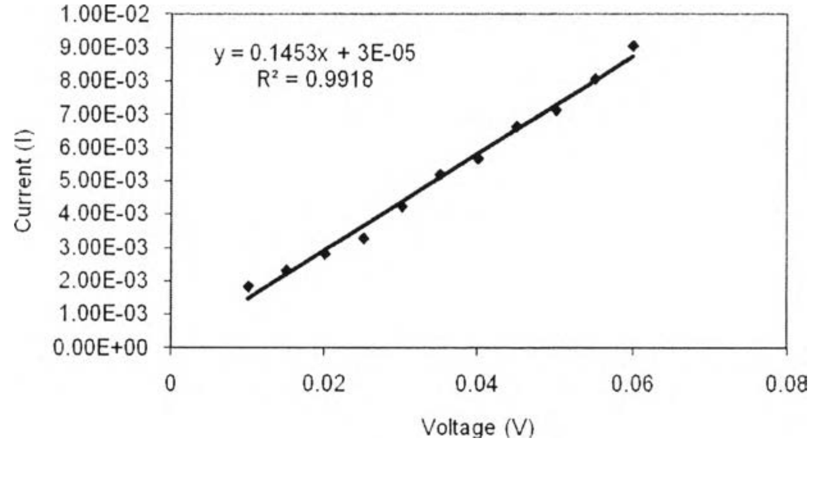
V			I			I, avg
1	2	3	1	2	3	
0.1	0.1	0.1	0.0110889	1.10E-02	0.0109723	1.10E-02
0.09	0.09	0.09	0.0099827	0.00993739	0.00992525	9.95E-03
0.08	0.08	0.08	8.82E-03	0.00881786	0.008811	8.82E-03
0.07	0.07	0.07	0.0077448	0.00774108	0.0077372	7.74E-03
0.06	0.06	0.06	6.68E-03	0.00667262	0.00666935	6.68E-03
0.05	0.05	0.05	5.26E-03	0.00524785	0.0052431	5.25E-03
0.04	0.04	0.04	0.0041869	0.00418937	0.00418661	4.19E-03
0.03	0.03	0.03	0.0031318	0.0031225	3.12E-03	3.13E-03
0.02	0.02	0.02	0.0020733	0.00207303	0.00207832	2.07E-03
0.01	0.01	0.01	0.001361	1.36E-03	0.00135994	1.36E-03



***I/V = slope =0.110**

Table B10 The ohmic regime of magnetic and silver particle-incorporated BC Sample prepared by using 0.50 M of aqueous iron ion solution and followed by using 0.100 M of silver nitrate solution (sample 3-3)

V			I			I, avg
1	2	3	1	2	3	
0.06	0.06	0.06	9.06E-03	0.00904891	9.00E-03	9.04E-03
0.055	0.055	0.055	0.008051	0.00805217	0.00804967	8.05E-03
0.05	0.05	0.05	7.12E-03	0.00712633	0.00711672	7.12E-03
0.045	0.045	0.045	0.0066386	0.00662914	0.00663172	6.63E-03
0.04	0.04	0.04	0.0056734	0.00566853	0.00566568	5.67E-03
0.035	0.035	0.035	0.0051984	0.00519371	0.00519372	5.20E-03
0.03	0.03	0.03	0.0042366	0.00423611	4.24E-03	4.24E-03
0.025	0.025	0.025	0.0032837	0.00328945	0.00328527	3.29E-03
0.02	0.02	0.02	0.0028154	0.00281776	0.00281544	2.82E-03



***I/V = slope =0.1453**

Table B11 The specific conductivity of magnetic and silver particle-incorporated BC sample

Sample reference	$[AgNO_3]$, (M)	Slope (I/V)	Thickness, t (cm)	Electrical conductivity (S/cm)
1-1		1×10^{-7}	0.0142	0.00219
1-2	0.010	1×10^{-7}	0.0153	0.00203
1-3		1×10^{-7}	0.0137	0.00227
2-1		0.0936	0.0261	1113.729
2-2	0.050	0.0858	0.0257	1036.808
2-3		0.0732	0.0252	902.100
3-1		0.1135	0.0183	1926.145
3-2	0.100	0.1106	0.0174	1974.013
3-3		0.1453	0.0212	2128.501

Specific conductivity (σ) = I/(V×K×t); K= 3.22E-03

Appendix C Crystalline size and percent incorporation of ZnO particle inside the as-prepared ZnO particle incorporated-BC at various preparation conditions

Sample Ref.	Preparation condition		Crystalline size (nm)	Percent incorporation of ZnO (%wt)
	Immersion time (h)	Ultrasonic treatment time (h)		
ZnO-BC/6/1	1	1	54.70	36.83 37.11 38.01
ZnO-BC/3/1	3	1	55.91	44.77 45.30 46.45
ZnO-BC/1/1	6	1	63.25	45.9279 46.5708 47.4548
ZnO-BC/3/0.5	3	0.5	59.53	44.8316 44.1264 43.8596
ZnO-BC/3/1	3	1	55.91	46.4573 45.2955 44.7733
ZnO-BC/3/2	3	2	53.83	45.659 45.3168 45.2905

Appendix D Colony forming unit counts (CFU/ml) at 0 h and 24 h contact time intervals with the as-prepared ZnO particle incorporated-BC against *E. coli* and *S. aureus*

Samples Reference	Percent incorporation of ZnO (%wt)	*E. coli* (CFU/ml)		
		Contact time		% Reduction in cell viability
		0 h	24 h	
BC	0	3.4×10^{7}	4.56×10^{7}	-34.1
			4.55×10^{7}	-33.9
			4.56×10^{7}	-34.2
ZnO-BC	37.32 ±0.61	3.4×10^{7}	7.80×10^{4}	99.77
			5.80×10^{4}	99.83
			6.80×10^{4}	99.80
	45.51 ±0.86	3.4×10^{7}	7.48×10^{4}	99.78
			7.14×10^{4}	99.79
			6.46×10^{4}	99.81
	46.65 ±0.77	3.4×10^{7}	7.48×10^{4}	99.78
			5.78×10^{4}	99.83
			7.14×10^{4}	99.79

Samples Reference	Percent incorporation of ZnO (%wt)	*S. aureus* (CFU/ml) Contact time 0 h	24 h	% Reduction in cell viability
BC	0	2.4×10^7	3.49×10^7	-45.3
			3.49×10^7	-45.4
			3.48×10^7	-44.9
ZnO-BC	37.32 ±0.61	2.4×10^7	5.04×10^4	99.79
			4.32×10^4	99.82
			5.28×10^4	99.78
	45.51 ±0.86	2.4×10^7	5.52×10^4	99.77
			5.04×10^4	99.79
			4.56×10^4	99.81
	46.65 ±0.77	2.4×10^7	5.76×10^4	99.76
			5.04×10^4	99.79
			4.32×10^4	99.82

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Publications:

1. Katepetch, C., & Rujiravanit, R. (2011). Synthesis of magnetic nanoparticle into bacterial cellulose matrix by ammonia gas-enhancing *in situ* co-precipitation method. Carbohydrate Polymers, 86, 162–170.
2. Katepetch, C., Rujiravanit, R., Tamura, H. (2013). Formation of nanocrystalline ZnO particles into bacterial cellulose pellicle by ultrasonic-assisted *in situ* synthesis. Cellulose, accepted manuscript.

Proceedings:

1. C. Katepetch and R. Rujiravanit (2009, August 17-21) Utilization of ammonia gas for green synthesis of antimicrobial-bacterial cellulose. Digest of Papers 19D- 10-50, Microprocesses and Nanotechnology 2009, 2009 International Microprocesses and Nanotechnology Conference, Sapporo, Japan.
2. C. Katepetch, R. Rujiravanit (2008, November 16-19) Preparation of epichlorohydrin-crosslinked carboxymethyl starch as a novel biodegradable superabsorbent polymer. Polymer Preprints 2008, 49(2), 789, American Chemical Society 236th National Meeting and Exposition, Philadelphia, USA.

Presentations:

1. Chaiyapruk Katepetch and Ratana Rujiravanit (2011, August 24-26). Preparation of magnetically responsive bacterial cellulose (MC-O-08, Oral presentation). The 6th International Symposium in Science and Technology at Kansai University 2011, Collaboration between Asian Countries in Science and Technology, Osaka, Japan.
2. Paweena Wongsakul, Chaiyapruk Katepetch, Ratana Rujiravanit (2010) Preparation and characterization of electrical responsive bacterial cellulose sheet Special Abstracts/Journal of Biotechnology, 150S, S1–S576.
3. Chaiyapruk Katepetch and Ratana Rujiravanit (2011, January 25-28). Biomimetic synthesis of nanocrystalline zinc oxide using bacterial cellulose template for antibacterial wound dressing application. The Eleventh International Symposium on Biomimetic Materials Processing, Nagoya University, Nagoya, Japan.
4. Chaiyapruk Katepetch, Tetsuya Furuike, Ratana Rujiravanit and Hiroshi Tamura. (2009, December 2-4). Preparation of hybrid hydrogel via γ-irradiation of cabboxymethyl amylopectin/bacterial cellulose (P107b). GelSympo 2009 Polymer Gels: Science and Technology as Advanced Soft Materials, Kansai University, Osaka, Japan.
5. Nitar Nwe, Tetsuya Furuike, Chaiyapruk Katepetch, Hiroshi Tamura and Ratana Rujiravanit. (2009, December 2-4). Porosity of chitosan and alginate scaffolds (P16a). GelSympo 2009 Polymer Gels: Science and Technology as Advanced Soft Materials, Kansai University, Osaka, Japan.
6. Chaiyapruk, K. and Ratana, R. (2009, August 23-25). Synthesis of magnetic nanoparticles in bacterial cellulose template (LP-27). International Symposium in Science and Technology, Kansai University, Osaka, Japan.
7. Chaiyapruk, K. and Ratana, R. (2009, October 20-23). Novel magnetic field responsive bacterial cellulose (Oral Presentation). The 1st The Federation of Asian Polymer Societies Polymer Congress, Nagoya, Japan.
8. Chaiyapruk, K. and Ratana, R. (2009, May 3-6). Preparation of Hydrogel by Chemical Modification of Bacterial Cellulose (S3-P30). PERCH-CIC Congress VI: the International Congress for Innovation in Chemistry, Pataya, Thailand.

9. C. Katepetch, P. Supapol, R. Magarapham and R. Rujiravanit. (2007, June 25-28) Preparation and Characterization of Cellulose Pulp-reinforced Natural Rubber/ Tapioca Starch Composite Foams. The 2nd International Conference on Advances in Petrochemicals and Polymers, Bangkok, Thailand.

10. C. Katepetch, P. Supapol, R. Magarapham and R. Rujiravanit. (2007, June 11-15) Preparation and Characterization of Cellulose Pulp-reinforced Natural Rubber/ Tapioca Starch Composite Foams. The 3rd China-Europe Symposium on Processing and Properties of Reinforced Polymers, Budapest, Hungary.

11. Chaiyapruk Katepetch, Ratana Rujiravanit, Rathanawan Magaraphan (2006, October 10-12) Effect of Natural Rubber Content on Morphology and Mechanical Properties of Starch-based Foam. The 32nd Congress on Science and Technology of Thailand, Bangkok, Thailand.