

REFERENCES

- Bak, H., Cho, S.Y., Yun, Y.S., and Jin, H.J., (2010) Electrically conductive transparent films base on nylon 6 membranes and single-walled carbon nanotube. Current Applied Physics, 10, 468-472.
- Balasubramanian, V., Kelkar, D.S., and Kurup, M.B., (1996) Electric conduction in ion implanted nylon-6 films. Nuclear Instruments and Methods in Physics Research B, 113, 257-260
- Bhavna, V.M., and Patil, S.V. (2014) Physical, structure, mechanical and thermal characterization of bacterial cellulose by G. hansenii NCIM 2529. Carbohydrate Polymers, 106, 132-141.
- Czaja, W., Krystunowicz, A., Bielecki, S., and Brown Jr., R.M. (2006) Microbial cellulose-the natural power to heal wounds. Biomaterials, 27, 145-151.
- Fukada, E. (2000). History and recent profress in piezoelectric polymers. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, 47(6), 1277-1290.
- Gang, W., Yano, O., and Soen, T. (1985) Dielectric and piezoelectric properties of nylon 9 and nylon 11. Polymer Journal, 18(1), 51-61.
- Harrison, J.S. and Z. Ounaies (2001). Piezoelectric Polymers. ICASE. Virginia: National Aeronautics and space Administration.
- Miri, V., Persyn, O., Lefebvre, J.M., and Seguela, R. (2009) Effects of water absorption on the plastic deformation behavior of nylon 6. European Polymer Journal, 45, 757-762.
- Nasrullah, S., Ul-Islam, M., Khattak, W.A., and Park, J.K. (2013) Overview of bacterial cellulose composites: A multipurpose advanced material. Carbohydrate Polymers, 98, 1585-1598
- Nogi, M and Yano, H. (2008) Transparent nanocomposites based on cellulose produced by bacterial offer potential innovation in the electronic device. Advanced Materials, 20(10), 1848-1852
- Page, I.B. (2000). Polyamide as engineering thermoplastic materials. Rapra Review Reports. Poland: Rapra Technology LTD.

- Peter, F., Kreammer, A., Neumann, W., and Gerhard-Multhaupt, R. (2004) Dielectric relaxation in piezo-, pyro- and ferro electric polyamide 11. IEEE Transactions in Dielectrics and Electrical Insulation, 11(2), 271-279.
- Peter, F.V., Cardona. T.D., Nout, M.J.R., Gooijer, K.D.D., and Heuvel, J.C.V.D. (2000) Location and limitation of cellulose production by acetobactor xylinum established from oxygen profiles. Journal of Bioscience and Bioengineering, 89(5), 414-419.
- Ramona-Daniela, P., Stoica-Guzun, A., and Stroescu, M. (2014) Composite films of poly(vinyl alcohol)-chitisan-bacterial cellulose for drug controlled release. International Journal of Biological Macromolecules, 68, 117-1240.
- Sampson, K.A., Mishra, A.K., and Waghmare, U.V. (2012) Dielectric and piezoelectric responses of nylon-7: A first-principles study. Journal of Polymer, 53(2751-2757).
- Takase, Y., Lee, J.W., Scheinbeim, J.I., and Newman, B.A. (1991) High-temperature characteristic of nylon-11 and nylon-7 piezoelectrics. Macromolecules, 24, 6644-6652.
- Thi, T.N., Sugiyama, J., and Bulone, V. (2010) Bacterial cellulose-based biomimetic composite. Biopolymer. Hirishima: Biomass Technology Research Centre, National Institute of Advanced Industrial Science and Technology.
- Tulysyan, K. (2007). Amorphous polyamide nanocomposite: Effects of Stability of The Nanoclay Modifier. Massachusetts: Department of Plastic Engineering, University of Massachusetts Lowell.
- Ul-Islam, M., Khan, T., and Park, J.K. (2012) Nanoreinforced bacterial cellulose-montmorillonite composites for biomedical applications. Carbohydrate Polymer, 89, 1189-1197.
- Ul-Islam, M., Khan, T., and Park, J.K. (2012) Water holding and release properties of bacterial cellulose obtained by in situ and ex situ modification. Carbohydrate Polymers, 88, 596-603.
- Vijaya, M.S. (2013). Applications in engineering and medical sciences, Piezoelectric Materials and Devices. New York: Taylor and Francis Group.

Yanhui, D., Zhang, P., Jiang, Y., Xu, F., Yin, J., and Zuo, Y., (2009) Mechanical properties of nylon-6/SiO₂ nanofiber prepared by electrospinning. Materials Letters, 63, 34-36.

Zhang, Q., Mo, Z., Zhang, H., Liu, S., and Cheng,S., (2001) Crystal transitions of nylon11 under drawing and annealing. Polymer, 42, 5543-5547.

APPENDIX

Appendix A Thermal Shrinkage (ASTM D2732)

The thermal shrinkage of PA/BC blend films was calculated as follow the equation 3.1

$$\% \text{ Shrinkage} = \frac{L_i - L_f}{L_i} \times 100 \quad (3.1)$$

Where L is initial length of side, L_f is length of side after shrinking

Table A1 Percent shrinkage of PA11/BC nanocomposite films with neat PA11

	Shrinkage (%)					
	130°C	140°C	150°C	160°C	170°C	180°C
Neat PA11	-	-	-	-	0.5	1
PA11/0.2%BC	-	-	-	-	-	0.5
PA11/0.4%BC	-	-	-	-	-	0.5
PA11/0.6%BC	-	-	-	-	-	0.5
PA11/0.8%BC	-	-	-	-	-	0.5
PA11/1%BC	-	-	-	-	-	0.3

Appendix B FT-IR Spectra of PA11 and PA11/BC nanocomposite.

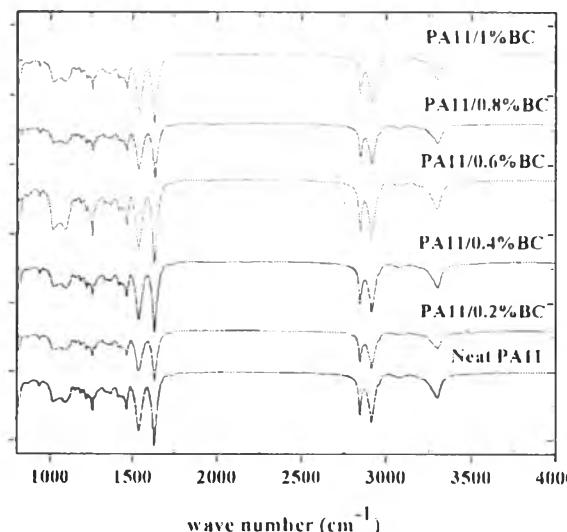


Figure B FT-IR Spectra of PA11 and PA11/BC nanocomposite.

CURRICULUM VITAE

Name: Mr. Weerasak Deachophon

Date of Birth: January 15, 1991

Nationality: Thai

University Education:

2009-2012 Bachelor Degree of Material science, Faculty of Science,
Chulalongkorn University, Bangkok, Thailand

Work Experience:

March-May2012 Position: Trainee

Company name : Thai Summit Mold Manufacturing Co., Ltd

Proceeding:

1. Deachophon, W and Manuspiya, H. (2015, April 21) Enhanced interfacial polarization of Polyamide/Bacterial Cellulose Nanocomposite Films for Touchscreen Applications. Proceedings of the 6th Research Symposium on Petrochemical and Materials Technology and The 20th PPC Symposium on Petroleum, Petrochemicals and Polymer, Bangkok, Thailand.

Presentation:

1. Deachophon, W and Manuspiya, H. (2015, May 20-22) Enhancement in Piezoelectric properties of Polyamide/Bacterial Cellulose Nanocomposite Films for Touchscreen Applications. Poster presentation at The Frontier Polymer Conference 2015, Riva del Garda, Italy.