

Fabrication and measurement of a new piezoelectric composite polymer film

蔡明濤、林見昌

E-mail: 325166@mail.dyu.edu.tw

ABSTRACT

In this study, Cyclic Olefin Copolymer(COC) and Polyvinylidene Fluoride(PVDF) are mixed in different weight ratios by a blender to make a thin electrode layer of COC/PVDF, respectively, and they are individually poled by high voltage field. Its piezoelectric properties are measured experimentally. Discussions and conclusions are made to the obtained results.

Keywords : COC、PVDF、Polymer blends、Poling、Piezoelectric Material、Composite materials

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REFERENCES

- [1] L.A. Utral, *polym.Eng. Sci.* 1982,22,1166.
- [2] SP Nunes, KV Peinemann, *Ultrafiltration membranes from PVDF/PMMA blends*. *J. Membrane Sci.*,73(1992)25-35.
- [3] JS Chiou, DR Paul, *Sorption and transport of inert gases in PVDF/PMMA blends*. *J. Membrane Sci.*,32(1994)793.
- [4] KF Wu, HL Sun, *Research on PAN/PS blend UF membrane*, *Techn..Water Treatment* 22(1996)85.
- [5] A. Langevin, *Utilisation de l'effet Piezoelectric*, Presses Unicersitaires de France, Paris (1942).
- [6] R.W.Wood and A.L.Loomis, "The Physical and Biological Effects of Intense Audible Sound on Living Organisms and Cells", *Ohil*, 4:417, May, 1927.
- [7] W.G. Candy, "The Piezoelectric Resonator", *Phys. Rev.*, 17, p531 (1921).
- [8] H. Thurnauer, "The Rochester Engineer", 21, p74 Nov. (1942).
- [9] B. Jaffe, R.S. Roth and S. Marzullo, *J. Res. Nat. Bur. Stds.*, 55, p239 (1995).
- [10] H. Kawai, *Ohyobutsuri*, 38 (1969) 1133; 39 (1970) 413; 39 (1970) 369.
- [11] G.T.Davis, J. E. Mckinney, M. S.C.Roth G. Broadhurst, *J. App1. Phys.*, 49(1978)4998.
- [12] Cheo-Hyum Han and Eun-Sok Kim, "Parylene-diaphragm piezoelectric acoustic transducers", *Tech. Dig. IEEE 13th Int. Conf. MicroElectro Mechanical System*, 1999, p505.
- [13] C.S.Lee J.Y. Kima, D.E.Lee, J.Joo, B.G.Wagh, S.Han, Y.W.Beag, S.K.Koh, *Flexible and transparent organic film speaker by using highly conducting PEDOT/PSS as electrode*, *Synthetic Metals* 139(2003)457-461.
- [14] S.C.Tjong, Y.Z.Meng, *European Polymer Journal*, 36, 123(2000).
- [15] B.LIN, U.Sundararaj, *J. Appl. Polym. Sci.*, 92, 1165(2004).
- [16] C.X.Li, Q.S.Kong, Q.R.Fan, Y.Z.Xia, *Materials Letters*, 59, 773(2005).
- [17] P.S.O.Patricio, J.A.de Sales, G.G.Silva, D.Windmoller, J.C.Machado, *J. Membrane Sci.*, 271, 177(2006).
- [18] Shih-Kai Cheng and Chuh-Yung Chen, "Mechanical properties and strain-rate effect of EVA/PMMA in situ polymerization blends",

European Polymer Journal, Vol. 40, PP. 1239-1248, (2004).

[19] J.A.Campbell,A.A.Goodwin, G.P.Simon,Polymer,42,4731(2001) [20] 趙家賢，聚碳酸酯/環煙烯聚合物摻合體性質探討，虎尾科技大學光電與材料研究所碩士論文，民國95年。

[21] P.Godard, J.M.Dekoninck, V.Devlesaver, J.Devaux, J.Polym. Sci., Polym.chem.Ed.,1986,24,3301.

[22] P.L.Wu, E.M.Woo, J.Polym,sci,phys.Ed.,2002,40,1571.

[23] N.Avramova, Polymer,1995,36,801.

[24] K.Y.Lim, B.C.Kim, K.j.Yoon, J.Appl.Polym.Sci.,2003,88,131.

[25] B.A.Auld, Acoustic Field and waves in solids , John Wiley & Sons. NEW YORK, vol.1, pp101-103, 1973.

[26] T. Mitsui, I. Tatsuzaki and E. Nakamura, “ An Introduction to Physics of Ferroelectric ” , GORDON AND BREACH SCIENCE PUBLISHERS,p.2 [27] 李雅明，固態電子學，全華科技圖書股份有限公司，(1995)pp.168-170。

[28] 謝煜弘，電子材料，新文京開發出版有限公司，(2003)。

[29] 吳朗，電子陶瓷入門，全欣資訊圖書股份有限公司，(1992)pp.159-161。