

改質型段式共聚醚酯-氨酯之研究

李大剛，陳賢文，蔡宏斌

國立宜蘭技術學院化工科

摘 要

本研究將過量之 1,5-戊二醇與二酸混合物[4,4'-聯苯二甲酸二甲酯 (dimethyl 4,4'-bibenzoate; BB) : 對苯二甲酸二甲酯 (dimethyl terephthalate; PTA)= 75:25 及 50:50] 依設定的人料比以聚縮合法生成二種分子量約 3,000 但不同成份之聚(4,4'-聯苯二甲酸-共-對苯二甲酸戊二酯)二醇[poly (pentamethylene 4,4'-binzoate-co-terephthalate)] glycol, 同時利用 ^1H NMR 鑑定其組成。再以此二種不同成份之聚(4,4'-聯苯二甲酸-共-對苯二甲酸戊二酯)二醇與 MDI(甲撐二苯異氰酸酯)及分子量 2000 之聚醚二元醇 PTMEG 以溶液(DMF)聚合生成硬段含量分別為 15% , 30% 及 45% 之熱向性段式共聚醚酯-氨酯。此系列段式共聚醚酯-氨酯具聚(4,4'-聯苯二甲酸-共-對苯二甲酸戊二酯)之硬鏈節及聚四甲撐醚的軟鏈節, 而可作為熱塑性彈性體。改變聚(4,4'-聯苯二甲酸-共-對苯二甲酸戊二酯)二醇之成份及其硬段含量(15% , 30% 及 45%)將對段式共聚醚酯-氨酯之熱學性質、機械性質及液晶性質, 均有很大的影響。不同結構組成之段式共聚醚酯-氨酯以 DSC(示差掃描熱卡計)測其熱學性質、拉力機研究其機械性質及以偏光顯微鏡及 X-射線繞射分析其結晶性質。並依此建立段式共聚醚酯-氨酯的結構-物性的關係。由實驗結果發現本系列共聚醚酯-氨酯成品具有良好之機械性質, 且其受組成影響甚鉅。由 DSC, 偏光顯微鏡及 X-射線繞射分析其結晶性質得知共聚酯寡聚合體之排列規則性及硬鏈節含量對聚醚酯-氨酯成品之結晶性質有決定性之影響。

關鍵詞: 段式共聚醚酯-氨酯，熱塑性彈性體，結構物性，熱性質

Investigation of Modified Block Copolyether-ester-urethanes

Da-Kong Lee, Hsien-Wen Chen and Hong-Bing Tsai

Department of Chemical Engineering

National I-Lan Institute of Technology

Abstract

Two poly(pentamethylene 4,4'-bibenzoate-co-terephthalate) glycols, molar mass about 3,000 with different composition are formed by melt polycondensation of 1,5-pentanediol and diacid mixtures [dimethyl-4,4'-bibenzoate:dimethyl terephthalate = 75;25 and 50;50] at fixed feed ratio. The poly(pentamethylene 4,4'-bibenzoate-co-terephthalate) glycols react with MDI and poly(tetramethylene ether)glycol (PTMEG, $M_n=2,000$) in DMF to form a series of block copolyether-ester-urethanes with hard segment content of 15%, 30% and 45%, respectively. The block copolyether-ester-urethanes are comprised of poly(pentamethylene 4,4'-bibenzoate-co-terephthalate) glycol as the hard segment and poly(tetramethylene ether) as the soft segment which shows rubbery behavior. They can be used as the thermoplastic elastomers. The composition of the hard segment and the hard segment content have great influence on the thermal properties, mechanical properties and liquid crystalline behavior of these block copolyether-ester-urethanes. The effects of hard segment composition and hard segment content on the thermal transitions, mechanical properties and liquid crystalline behavior are characterized by DSC (differential scanning calorimetry), universal tensile test machine and wide-angle X-ray diffraction respectively. From tensile results, the block copolyether-ester-urethane shows good mechanical properties,

which affects by the hard segment composition and hard segment content, significantly. The liquid crystalline behavior are investigated by DSC, wide-angle X-ray diffraction and polarized microscopy. Only the copolyetherester-urethanes with higher BB content in hard segment and higher hard segment content (BT0-45) display monotropic liquid crystalline behavior.

Keywords: Block copolyetherester-urethanes, liquid crystalline behavior, thermoplastic elastomers, thermal properties, structure-property relationships