Study of Side-Chain Copolymers Containing H-Bonded / Covalent Bent-Core Mesogen

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Abstract

Conventional free radical polymerization has been used to synthesize side-chain copolymers with H-bonded/covalent bent-core mesogen. The molar ratio of resulting polymers exhibiting smectic layer arrangement is characterized by NMR spectroscopy. The synthesis of the desired bent-core complexes required two components (H donor and H acceptor) to be mixed in precise equimolecular proportions in a common solvent (THF) followed by removal of the solvent. Differential scanning calorimetry, thermo-polarized optical microscopy, wide-angle X-ray diffraction are used to characterized the liquid crystal phases of all studied materials involving covalent low molecular weight bent-core mesogens, acrylate monomers and side-chain H-bonded complexes. The electro-optic measurement is carried out by applying a triangular wave field. It is not until the constitutional ratio of H-bonded/covalent bent-core mesogen in copolymer was tuned to 10/1 that the complex exhibit ferroelectric (FE) property. Only one current peak can be clearly identified within a modified triangular wave indicating the FE behavior and Ps value is measured to be 50~130 $nCcm^{-2}$.

含氫鍵與共價鍵彎曲型液晶基側鏈共聚高分子之研究

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摘要

含氫鍵與共價鍵彎曲型共聚高分子運用常見自由基聚合已被成功合成出。此系列共聚高分子液晶相為層狀排列結構，可藉由核磁共振光譜儀估算氫鍵部份佔整體共聚高分子比例。將二種成份（分別為質子予體與質子受體）以當量比 1:1 含量共同溶四氫氟喃溶劑，待溶劑自然揮發即合成出所需彎曲型錯合物。藉由示差掃描熱量計、偏光顯微鏡及廣角 X 光繞射，鑑定本實驗開發材料，其中包括共價鍵小分子香蕉型液晶、壓克力基單體與側鏈型氫鍵錯合物。並且運用三角波電壓法量測所有材料光電特性。本實驗發現，當氫鍵與共價鍵組成比例為 10:1 時，其氫鍵錯合物展現鐵電行為，即使使用修飾三角波，在半週期處發現一根明顯特徵峰，為典型鐵電特性。其自發極化值大約 50~130 $nCcm^{-2}$。

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