Regulation of Polymer Conformation Using Light

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helical conformation is induced for a linear polyfluorene derivative (poly(9,9dioctylfluorene-2,7-diyl [PDOF]) in the solid state when the polymer is irradiated with CPL (Scheme 1). A series of work was initiated by the finding of photo racemization of a preferred-handed helical polyacrylate where side-chain biphenyl moiety in the polymer underwent "twist-coplanar transition" on photo excitation with non-polarized light.^{4,5} This work was extended to CPL-driven helix formation of poly(9,9-di-n-octylfluorene-2,7-diyl) in a thin film form where 5/1-helix is reversibly formed by CPL irradiation. This methodology has been extended to other polymer chains.



^{1,2} The mechanism of this chirality induction involves a twisted-coplanar transition (TCT) of an aromatic–aromatic junction in the polymer where one of the enantiomeric, right- and left-handed twists is preferentially excited into the coplanar conformation. TCT through photo excitation was first predicted for biphenyl through theoretical calculations.³

In the CPL-driven helix formation of the linear polyfluorene derivative, strong interchain interactions were important in effectively induce chirality, which in turn implicates that polymers with weak inter-chain interactions cannot be subjected to the CPL method. This weak point of the CPL method was over come via using aid molecules which reinforce or simulate inter-chain interaction. This method was realized for a star-shaped fluorene oligomer which had been designed to have only weak inter-chain interactions.⁴ The applicability of the CPL method was thus largely extended.

Fig.1 Chemical structure (top) and 5/1-helical conformation (bottom) of PDOF.

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