

演題: Influencing Materials Properties in Subtle Ways: Chirality, Switches and Machines

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日時: 2008年5月16日(金)16:00~17:00
場所: 工学部材料・化学棟大会議室(MC526)
共催: 第17回生物機能高分子セミナー

要旨: Restricting the conformational degrees of freedom within a polymer's backbone can have the effect of extending the chain and endows the material with a number of interesting properties including helicity, chirality and liquid crystallinity. Moving from achiral to homochiral materials can induce further alteration and improvement of properties. The helix motif is a versatile structure that has applications in a number of important technological areas which include optical devices, piezoelectric materials, electromechanical actuators, pyroelectric materials, ferroelectric materials, chiral separations and sensors and biomimetic polymers. Single screw-sense polymers have properties vastly different than their racemic analogues. In order to form single screw-sense polymers from achiral monomers (carbodiimides), we have been investigating their polymerization with chiral catalysts. We recently discovered that titanium binaphthol complexes will catalyze these reactions to give polymers displaying a predominance of a single screw-sense. The resulting polymers with polyaromatic side chains (naphthalene, anthracene) have very unusual properties that include a facile and pronounced chiroptical switching (e.g., +300° to -200°) near body temperature. Analysis indicates that the switching behavior is related to the reorientation of the anthracene ring relative to the helix director. Switching can be driven by temperature, polarity and electric fields. The synthesis and utility of these chiral polymers will be discussed.

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