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Helical structures and chiroptical properties of multifunctional conjugated polymers

Conjugated polymers have been attracting current interests because of their peculiar structures and optoelectronic properties. Hierarchically assembled conjugated polymers are anticipated to exhibit highly enhanced helical structures and chiroptical properties. Dynamic controls of helical sense and circular polarization using external stimuli are of particular interest from aspect of next-generation multifunctional materials useful for electronic and photonic applications. Herein, we present current advances in multifunctional materials constructed with hierarchically assembled conjugated polymers with photoresponsive helical sense and circularly polarized luminescence; (i) circularly polarized blueπluminescent spherulites consisting of helically -stacked ionic conjugated polymers, (ii) photochemically switchable RGB and white illuminants based on conjugated polymer nanospheres, (iii) liquid crystallinity-enforced chirality transfer from chiral mono-substituted polyacetylene popolymer to poly(para-phenylene ethynylene) and (iv) switching of circularly polarized luminescence of chiral conjugated polymers by selective reflection of chiral nematic liquid crystals. The mixture of a cationic poly (para-phenylene) derivative and an anionic chiral binaphthyl derivative forms a hierarchically self-organized assembly π with an interchain helically-stacked structure stabilized by the presence of both electrostatic and π_π interactions. The electrostatic π and _π interactions are essential to the stability π of the -stacked structure, resulting in large dissymmetry factors of in absorption and luminescence. It was demonstrated that the polymer assemblies further gathered to form stacked structure stabilized by the presence of both electrostatic and factors of in absorption and luminescence. It was demonstrated that the polymer assemblies further gathered to form spherulites, which can be regarded as semi-crystalline nanospheres, which exhibit circularly polarized blue luminescence Chiral mono-substituted polyacetylene copolymers, consisting of a liquid crystalline and a chiral monomer unit, were synthesized. The synergistic effects between the liquid crystalline and chiral monomer units were utilized to enable the chirality transfer from the copolymer to an achiral conjugated polymer. The liquid crystallinity-enforced chirality transfer from the copolymer to achiral conjugated polymers was demonstrated.

Biography

Kazuo Akagi has completed his PhD from Kyoto University in 1980. He has received the title of Professor Emeritus from University of Tsukuba (2009) and Kyoto University (2017). He is now an Eminent Research Professor of Ritsumeikan University. He was awarded The Divisional Award of The Chemical Society of Japan (1999), NISSAN Science Prize (2000), Tsukuba Prize (2001), The Award of the Society of Polymer Science, Japan (2002), The Commendation for Science and Technology by MEXT, Prizes for Science and Technology (2005), The Award of the Japanese Liquid Crystal Society (2010) and The Chemical Society of Japan Award (2017).

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