【Science and engineering（Chemistry）】

# Synthesis of Conjugated Polymers with Higher-Ordered Helical Structures in Helicity-Controllable Liquid Crystal Field and Their Functional Properties

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**【Outline of survey】**

Currently, we succeeded in synthesizing helical polyacetylene (H-PA) with super-hierarchical helical structure in chiral nematic (cholesteric) liquid crystal (N*-LC). The N*-LC is prepared by adding a small amount of chiral compound, as a chiral dopant, into nematic liquid crystal. The synthesis using the N*-LC enabled us to control the helical sense of polymer product, by selecting the helicity of the chiral compound. Besides, the present method is applicable for not only chemical polymerizations but also electrochemical polymerizations, leading to various types of helical conjugated polymers.If the helical sense and helical pitch of the N*-LC is controllable by an external perturbation such as temperature and light, those of the resultant polymer can be easily controlled by using one kind of N*-LC as an asymmetric reaction field.The present study is aimed to construct novel N*-LC reaction field whose helical sense is dynamically and reversibly controlled by changing only temperature or wave number of irradiating light, and also to elucidate novel functional properties derived from higher-order helical structures of the resultant conjugated polymers.

**【Expected results】**

(1) Advanced N*-LC reaction field, whose helical sense is controllable through temperature or light, can be constructed.
(2) Helical sense and helical pitch of the resultant polymer can be well controlled by changing only temperature or wave number of irradiating light in N*-LC reaction field.
(3) Novel functional properties, such as amplified circularly polarized luminescence and induced solenoid magnetism, might occur owing to higher-order helical structures.
(4) The present method could be a highly versatile procedure for affording helical structures to various kinds of conjugated and non-conjugated polymers.
(5) It is expected that asymmetric synthesis and polymerization using the chiral liquid crystal with dynamically controllable helical sense might largely progress as a new interdisciplinary research field.

**【References by the principal investigator】**

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・K. Akagi, "Helical Polyacetylene Synthesized in Chiral Nematic Liquid Crystal", Handbook of Conducting Polymers, Third Edition, Conjugated Polymers, Eds. T. A. Skotheim and J. R. Reynolds. CRC Press, New York, 3-3 - 3-14 (2007).

| 【Term of project】 FY2008 －2012 | 【Budget allocation】 **151,400,000 yen** (direct cost) |
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【Homepage address】 http://star.polym.kyoto-u.ac.jp/AkagiGHP/indexA.html