fast breaking papers - 2010

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Takashi Kato & Takuma Yasuda talk with *ScienceWatch.com* and answer a few questions about this month's Fast Breaking Paper Paper in the field of Materials Science.

Article Title: pi-Conjugated Oligothiophene-Based Polycatenar Liquid Crystals: Self-Organization and Photoconductive, Luminescent, and Redox Properties

Authors: **Yasuda, T**;Ooi, H;Morita, J;Akama, Y;Minoura, K;Funahashi, M; Shimomuro, T;**Kato, T**
Journal: ADV FUNCT MATER, Volume: 19, Issue: 3, Page: 411-419, Year: FEB 10 2009
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(addresses have been truncated.)

SW: Why do you think your paper is highly cited?

This paper describes a simple and versatile strategy for the development of electro- and photo-functional nanostructured materials based on p-conjugated molecules. The fabrication of well-defined complex architectures based on functional molecules within molecular condensed states remains a major challenge in the fields of chemistry and materials science.

We believe that the induction of liquid-crystalline order into p-conjugated materials is one of the most promising approaches. Use of liquid-crystalline molecular order enables us to control molecular self-organization processes and to induce dynamic and anisotropic functionalities. The liquid-crystalline organic semiconductors based on our design will be fascinating, not only for fundamental chemical and physical researches, but also for industrial applications.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Our work offers a promising combination of liquid crystals and p-conjugated semiconductors for the development of a new class of functional soft materials. We suppose that this is one of the first attempts toward the development of functional p-conjugated liquid crystals that are capable of forming layered (2D), columnar (1D), and globular (0D) nanostructures by self-assembly processes. Our design strategy may thus be applied for the fabrication of organic electronic devices with tunable properties.

Coauthor: Takuma Yasuda

SW: Would you summarize the significance of your paper in layman's terms?

Liquid crystals are unique materials that combine molecular organization and fluidity, and are now applied to informational displays. Proper design of liquid crystals by adopting a variety of structures and interactions leads to wider applicability as functional materials.

We have succeeded in combining unique electro- and photo-functions of p-conjugated organic semiconductors with dynamic and directionally-dependent properties of liquid crystals. This basic subject is of importance for the development of flexible organic electronic devices as well as solar cells.

SW: How did you become involved in this research, and were there any problems along the way?

Over the past two decades, our group has been working on self-assembled functional materials, including supramolecular liquid crystals, liquid-crystalline physical gels, ion-conductive liquid crystals, and organic/inorganic hybrid materials (T. Kato *et al*., "Functional liquid-crystalline assemblies: self-organized soft materials," *Angewandte Chemie International Edition* 45: 38-68, 2006; T. Kato, "Self-assembly of phase-segregated liquid crystal structures," *Science* 295: 2414-18, 2002).

Our group has also started projects on the preparation and applications of p-conjugated molecules as a new platform of functional soft materials in order to develop more sophisticated advanced materials for energy conversion and transportation. This has recently resulted in the development of functional liquid crystals based on p-conjugated structures.

SW: Where do you see your research leading in the future?

Our materials design and concept will be expanded to a variety of p-conjugated functional entities to further understand how differences in molecular structures affect properties and functions of the condensed materials. The structural versatility of our materials allows the fabrication of functional soft materials with tailor-made properties.

We expect that our liquid-crystalline materials will make a greater impact in the materials science field, and will be used in the future as active materials in light-emitting diodes, field-effect and light-emitting transistors, and solar cells with improved performances.

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