Session IV: Functional Colorants

Synthesis and Physical Properties of Color Liquid Crystals Transition Metal Complexes

Prof. Kazuchika Ohta

Emeritus Professor,Shinshu University,Japan

Prof. Ohta completed his Ph.D. degree from Osaka University, Japan in 1981. He worked as a Researcher at Toshiba's R&D Centre for a year and moved to Shinshu University in their Department of Functional Polymer Science as Assistant Professor and where he is still continuing as Research Professor. He has spent one year each in CNRS, France and Delft Institute of Technology, Netherland as Visiting Researcher. Prof. Ohta's research interests include synthesis of metallomesogens, chromic liquid crystals and highly conductive discotic liquid crystals.

In 2001 the Japanese Liquid Crystal Society awarded Prof. Ohta the 'Best Paper Prize in Liquid Crystals and in 2016 honoured him with its Achievement Award. He was also bestowed with the 'Excellent Award' by the journal Advances in Microwave Green Chemistry in 2015. Prof. Ohta is a member of the Chemical Society of Japan, the Japanese Liquid Crystal Society and the International Liquid Crystal Society.

Prof. Ohta has published 180 papers in top-class journals and has authored 10 books and 11 reviews.

Abstract

This presentation will first explain the notion of liquid crystals in order to acquaint those participants unfamiliar with this field.

The effect of the central metal in metallomesogens (liquid crystals of metal complexes) on their color and physical properties will be discussed next. Three kinds of metallomesogens will then be described. The chemistry displayed by glyoxime-based metallomesogens for directly visualizing van der Waals forces will be discussed. Thus, the long chain alkoxy group-substituted platinum complex is green at room temperature but turns red on heating. This color change is on account of pressure induced by the van der Waals force of peripheral chains. NIR dyes of the dithiolene-based metallomesogens will be discussed next. The interesting dependence of π-acceptor ability on the central metal in these molecules was revealed from the cyclic voltammetric data and electronic spectral data. In case of the liquid crystalline phthalocyanine d-block metal(II)-based complexes, it is found that the number of d-electrons has an effect on the stacking distance in the columnar liquid crystalline phases. For the liquid crystalline phthalocyanine f-block metal(III)-based sandwich complexes, we found for the first time that magnetic Coulomb force is added to the intermolecular force to form liquid crystalline phases. The liquid crystalline phthalocyanine lutetium sandwich complexes are electrochromic and show three primary colors. Finally, the role played by liquid crystalline Pc-C_{60} dyads in the development of organic thin film solar cells will be discussed. We have developed liquid crystalline Pc-C_{60} dyads that show perfect homeotropic alignment between two glass plates and very unique spiranthes-like supramolecular structure.