Mesogenic semiconductors for large-scale electronics

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Liquid crystal (LC) is one of the promising materials as an organic semiconductor because of potentially high carrier mobility based on their self-organizing characteristics. We have so far demonstrated a high carrier mobility in excess of 1 cm^2/Vs in non-peripheral (np) substituted phthalocyanine, 1,4,8,11,15,18,22,25-octaoctylphthalocyanines (CnPc) and their families [1, 2]. The CnPc derivatives shows a unique temperature dependence of the carrier mobility which must be related to the phase structure of this material. We have also demonstrated a high-efficient bulk-heterojunction (BHJ) solar cell based on $C6PcH_2$ and their family, which shows a high power conversion efficiency of 5.3% [3–5]. For the formation of the optimally phase-separated nano-structure for efficient carrier generation and transportation, the mesogenic properties should play an important role.

Using self-organizing characteristics of LC phase, we can fabricate a large area monodomain thin film of CnPc for electronic devices. A well-aligned uniaxial single crystal growth in large area of printed thin film was obtained by means of conversion process from LC phase in a supercooled state to crystal phase. We have also demonstrated a large area single crystalline film converted from spin-coated polycrystalline film, which is based on the crystal polymorphism conversion triggered by the solvent vapor treatment [6].

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Speaker Biography

Masanori Ozaki received his B.E., M.E. and D.E. degrees from Osaka University in 1983, 1995, and 1988. He joined Department of Electronic Engineering in Osaka University as a research associate in 1988, and was promoted to an Associate Professor in 1994 and to a full Professor in 2005. He has been engaged in the research on physical properties and applications of organic functional materials, particularly liquid crystals and conjugated polymers. He stayed in Physics Department at University of Utah from 1994 to 1995 as a visiting scientist and studied spectroscopy of conjugated polymers. He received many awards such as Japan Liquid Crystal Society Outstanding Achievement Award, Japan Society of Applied Physics Fellow and so on. His current research interests are nano-structured organic materials and their application to electronic and photonic devices.