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Strongly red-shifted photoluminescence band induced by molecular twisting in cyanine (Cy3) dye films

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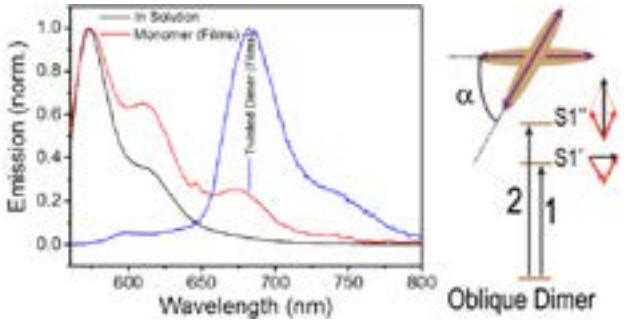
Cyanine dye molecules, used as monomers or in aggregate form, find interesting applications in opto-electronic devices. Among the various aggregate species incorporating organic dyes, centrosymmetric dimers are known as non-luminescent. They can act as exciton quenchers due to a low energy optically forbidden excited state. In this study, however, we show that a dimer species in thin films exhibits efficient and strongly red-shifted photoluminescence. When the films were excited, a monomer emission at 590 nm along with a second emission peak at 680 nm was observed. Temperature dependent fluorescence was studied for cyanine films. The dimer emission increases with decreasing temperature due to reduced non-radiative process becoming less effective. A close relation between the dye concentration and the emission showed that a new emission at 680 nm corresponds to the dimer emission. Circular dichroism (CD) spectroscopy reveals that a fraction of the dimers exists in a twisted dimer configuration. Stable, long-lived and quenchable fluorescence with high quantum yield are attributed to this dimer emission. Organic light emitting electrochemical cells (OLECs) fabricated with this dye showed a higher luminance owing to the dimer emission.



Biography

Surendra Anantharaman has his expertise in growth and optical characterization of organic dye films. He completed his Bachelor degree in Physics at Anna University, India; Master's degree in Materials Science and; M S at Indian Institute of Technology Madras, India. His Master's thesis was on 'Electrolyte materials for intermediate temperature solid oxide fuel cells'. His area of research interest lies in oxides, nitrides and organic molecules focusing on energy harvesting applications. After working as an Engineer at Taiwan Semiconductor Manufacturing Company (TSMC), Taiwan; he joined as PhD student at École Polytechnique Fédérale de Lausanne (EPFL) in 2015 under the guidance of Prof. Dr. Frank Nüesch and Dr. Jakob Heier. As a PhD student, he is working on understanding the growth of organic crystals and its methodology from the morphology and surface-molecule interactions in the Laboratory for Functional Polymers at Swiss Federal Laboratories for Materials Science and Technology, Switzerland.

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