INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Electronic devices have made people's life easier, and in today's modern lifestyle electronic devices have become one of the basic requirements of human beings. Inorganic material are used extensively in electronic devices but the requirement of energy efficient, low-cost and flexible devices can be easily fulfilled by the organic solution processable materials. Organic field effect transistors (OFET) will enable easy implementation of large scale and flexible applications. Organic materials also have the advantage of easy tunability of the optoelectronic properties. OFETs have numerous applications like various sensors, smart card, e-skin etc. Some of the organic electronic devices like OLED, solar cell is already available in market, but low mobility and stability is a road block for organic transistors to be commercialized in high end applications.

Considering todays need for solution processed, flexible and energy efficient organic electronic devices, methods to understand the dielectric/semiconductor interfacial defects introduced due to solution processing and techniques to improve the device properties is covered in this thesis. This thesis is divided into three parts, the first part (Chapter 2) is about the understanding the interfacial defects arising due to complete solution processing of the dielectric and semiconductor. Second part (Chapter 3 and 4) consists of solvent engineering technique to improve the device mobility and stability. A ~5-fold increment in device mobility and also improvement in device stability in dark and under illumination is attained by solvent engineering. Third part (chapter 5) is the application of the improved device in various opto-electronic applications thereby, NOT and NOR logic are demonstrated by applying light and voltage input simultaneously.

The efforts made in this thesis highlights the usefulness of various device engineering to develop OFET to regulate the morphology and crystallization of the photo-active semiconductor layer to achieve highly efficient, stable and repeatable OFETs and its application as phototransistor, and logic gates. The thesis provides the basis for facilitating the commercialization of OFET in the near future.