INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Design, Synthesis and Investigations of Liquid Crystalline Organic Semiconductors**

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SHORT ABSTRACT

This thesis entitled "*Design, Synthesis and Investigations of Liquid Crystalline Organic Semiconductors*" describes simple and straightforward synthetic pathways, characterizations and applications of new LC/non-LC organic materials, with their potential applications in acid sensing, optoelectronic devices mainly OLEDs and OFETs applications. A brief overview of the chapters is given. Chapter 1, gives a general introduction to liquid crystals, characterization techniques and their applications. Chapter 2a addresses the synthesis and characterization of pyrazino[2,3-g]quinoxaline (PQ) derivatives where the central pyrazino[2,3-g]quinoxaline central core is substituted with eight peripheral flexible tails of varying lengths. The compounds with very short/branched peripheral chains did not stabilize any liquid crystalline phase, while the medium to long-chain homologs exhibited columnar phases. All the compounds exhibited a high molar extinction coefficient and bright greenish-yellow emission behavior in solution and solid state. One of the columnar liquid crystalline materials was used in the fabrication of host-guest OLED exhibited higher efficiency and bright green emission. Chapter 2b describes the sensing ability of the pyrazino[2,3-g]quinoxaline derivative to volatile trifluoroacetic acid in trace amounts (in parts per billion levels). The reversible detection of acid-sensing behavior was visually perceivable in both solutions as well as in the drop-casted film on a TLC paper-based strip. Chapter 3 explains new design strategies for the synthesis of donor-acceptor-donor pyrazino[2,3-g]quinoxaline carbazole derivatives with straight chain and branched alkyl peripheral chains. The electron-donating carbazole moieties that have been placed in the periphery showed a strong electron-donating ability, high molar extinction coefficients and lower band-gap, bright emission behavior in solution and solid-state, along with positive solvatochromism. One of the branched chain compounds was used in yellow and white OLEDs device fabrications. Chapter 4 describes the detailed synthesis of naphthalene and perylene-based imidazole derivatives with a new donor-π-acceptor-π-donor architecture containing ten flexible chains for solution-processable organic field effect transistor (OFETs) applications. These compounds showed a wide range of columnar LC behavior. One of these naphthalene and perylene bisimide derivatives were evaluated for their application in OFET devices exhibited high hole mobility values.