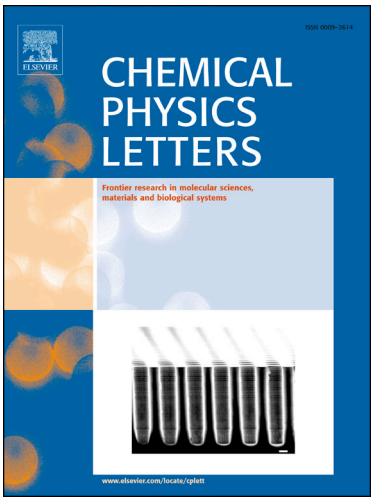


Research paper

# Chemical Oxidative and Solid State Synthesis of Low Molecular Weight Polymers for Organic Field Effect Transistors

Rajashree Y. Mahale, Satej S. Dharmapurikar, Mrinmoy Kumar Chini

PII: S0009-2614(18)30106-4
DOI: https://doi.org/10.1016/j.cplett.2018.02.021
Reference: CPLETT 35433

To appear in: *Chemical Physics Letters*

Received Date: 28 November 2017
Accepted Date: 7 February 2018

Please cite this article as: R.Y. Mahale, S.S. Dharmapurikar, M.K. Chini, Chemical Oxidative and Solid State Synthesis of Low Molecular Weight Polymers for Organic Field Effect Transistors, *Chemical Physics Letters* (2018), doi: https://doi.org/10.1016/j.cplett.2018.02.021

# Chemical Oxidative and Solid State Synthesis of Low Molecular Weight Polymers for Organic Field Effect Transistors

Rajashree Y Mahale, Satej S Dharmapurikar, and Mrinmoy Kumar Chini*

Polymers and Advanced Materials Laboratory, CSIR-National Chemical Laboratory, CSIR-Network of Institutes for Solar Energy, Pune-411008, India. E-mail: mrinmoychini@gmail.com

**Abstract:** Solution processability of the precursor molecules is a major issue owing to their limited solubility for the synthesis of conjugated polymers. Therefore, we favour the solvent free solid state chemical oxidative polymerization route for the synthesis of diketopyrrolopyrrole (DPP) based donor-acceptor (D−A) type conjugated polymers. D−A type polymer Poly(S-OD-EDOT) which contains DPP coupled with EDOT donor units is synthesized via solid state polymerization method. The polymer is employed as an active layer for organic field-effect transistors to measure charge transport properties. The Polymer shows good hole mobility $3.1\times10^{-2}$ $cm^2$ $V^{-1}$ $s^{-1}$, with a on/off ratio of $1.1\times10^3$.

**Keywords:** Solvent free synthesis, oxidative, opto-electronic, mobility, organic field-effect transistor

## Introduction

Conjugated polymers with donor−acceptor (D−A) architecture received attention for their application in devices such as organic photovoltaics (OPVs),[1,2] organic field effect transistors (OFETs)[3,4] and organic light-emitting diodes (OLEDs)[5] because of their excellent optoelectronic properties[6] such as stability, low-band gap by means of hybridization of the energy levels of the donors and acceptors.[7,8] Recently, D−A conjugated small molecules and polymers containing strong electron acceptors bearing lactam groups such as diketopyrrolopyrrole (DPP) exhibited strong intramolecular charge transfer leading to good charge transport properties.[9-11] The electron-deficient DPP core possess planar backbone, and have intermolecular hydrogen bonding which results in materials with strong π−π stacking interactions,[12-15] favouring high-performance in electronic devices. Association of DPP with appropriate electron donating unit in D-A polymer leads to strong interaction in solid state through intermolecular D–A and π–π interactions, leading to highly ordered structures at the molecular levels. The charge transport efficacy of a conjugated alternating D-A polymer would depend on donor and acceptor moieties and it can be modulated by the relative donor and acceptor strengths and nature of π-conjugation within the polymer framework.[16,17]

3, 4 Ethylenedioxythiophene (EDOT) is considered as an effective donor unit due to its relatively high HOMO energy level and small steric interaction between repeating units.[18]