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## Novel donor-acceptor low band gap copolymers for bulkheterojunction (BHJ) solar cells

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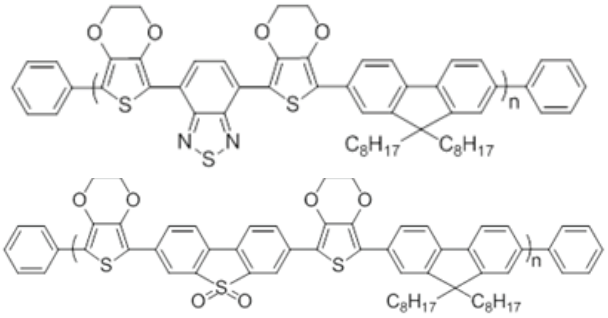
Tremendous advances have been achieved over the past decade in the area of design and synthesis of novel conjugated polymers for bulk heterojunction (BHJ) solar cells and light emitting diodes (LEDs). With ingenious use of variety of synthetic techniques, researchers have synthesised copolymers with optimized physical properties. For instance, an organic photovoltaic (OPV) material showing a record-breaking power conversion efficiency (PCE) of 10 ± 0.3 % has been reported recently [1]. In the design of semiconducting copolymers, the donor-acceptor (DA) approach has been found to afford low band gap (LBG) copolymers with broad absorptionto efficiently harvest solar energy [2,3].

Here we report the synthesis of two novel LBG copolymers (PFDEBT and PFDES) and studies of their photo-physical and electrochemical properties, for prospective use in organic electronics.



PFDES

PFDEBT with benzothiadiazole acceptor moiety demonstrated bathochromic shift of absorption from 578 nm in solution to 591 nm in the solid state with an optical band gap of 1.69 eV, while PFDES containingdibenzothiophene-S,S-dioxide unit showed absorption at 489 and 494 nm in both the liquid and solid states respectively with an optical band gap of 2.25 eV. Both polymers are highly emissive materials; with the former emitting in the red region of the emission spectrum attaining emission λmax of 709 nm and 28% photoluminescence quantum yield (PL Φ) in solution, while the later emits in the green region with an emission λmaxof 517 nm and 55% PL Φ. The HOMO energy levels of the polymers estimated from cyclic voltammetry analysis are - 4.9 and - 5.1 respectively. Preliminary studies of BHJ solar devices ofthe blend of these copolymers with PC60BM showed PCE of 1.45% and 1.1% for PFDEBT and PFDES respectively for non-optimised devices.p

**Keywords:** donor-acceptor conjugated polymers, low band gap, organic photovoltaicand organic light emitting diodes.

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## Study of the grain growth process of WC-Co nano composites

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The present work describes the aspects of grain growth process of different tungsten carbide-cobalt (WC/Co) nano composites sintered using liquid phase sintering (LPS). The composites were prepared using tungsten carbide nano particles synthesized by solvo-thermal process and commercially available cobalt nano particles as binder material for these particles. Sintering parameters; temperature, time and binder composition were varied to study the grain growth process. In these composites no grain growth inhibiters was used. Sintered composites were analysed using scanning electron microscope (SEM) and x-ray diffraction (XRD). The microstructural examination showed that the grain growth occurred through coalescence. The XRD analysis showed that no 'η' phase or any other unwanted phases were present in all the sintered composites.

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