A Novel n-Channel Organic Semiconductor Based on Pyrene-phenazine Fused Monoimide and Bisimide

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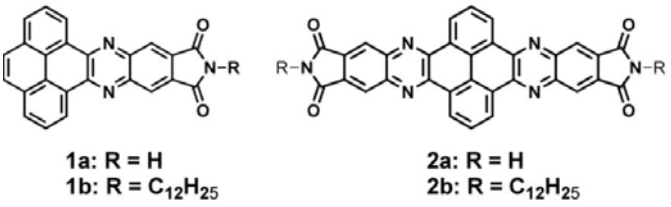
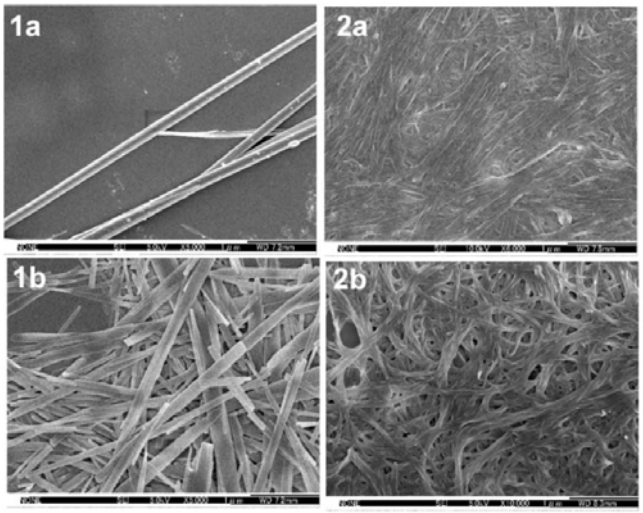
Synthesis of organic n-channel semiconductors is of increasing interest due to their utility in organic complementary inverters upon integration with p-channel semiconductors.[1] However, there are only fewer n-channel semiconductors compared with p-channel counterparts. Typical examples of n-channel semiconductors reported up to date have been limited to naphthalene bisimides,[2] perylene bisimides,[3] fullerene and its derivatives,[4] and perfluorinated conjugated molecules such as fluorinated copper phthalocyanines. [5]

Here we report the synthesis of a new type n-channel semiconductor based on pyrene fused phenzaine monoimide and bisimides (Figure on the right side; 1a and 2a). We also report their self-assembly to form well-defined nanostructures, as investigated by FE-SEM, TEM, AFM and XRD measurements. In order to tune self-assembly structure and improve solubility for solution-process device fabrication, dodecyl chains were anchored to the N-termini of the monoimide and bisimide derivatives (1b and 2b). Both the non-substituted and didodecyl-anchored bisimides self- assemble to give highly ordered nanobelts. Cyclic voltammetry measurement shows two redox peaks in negative potential region. The conductivity of the assembled nanobelts was investigated by a two-probe method on a 10-μm Pt gap. Upon doping with hydrazine,[6] the nanobelt shows a largely enhanced electric current.





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