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ABSTRACTS

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Advanced Bio-sensing, Optical Bar-code, and Super-lattice Applications using Light-emitting Organic Nanowires

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Organic nanowires (NWs) of conjugated poly (3-methylthiophene) (P3MT), poly (3-butylthiophene) (P3BT), and poly (3,4-ethylenedioxythiophene) (PEDOT) were fabricated. Through a laser confocal microscope (LCM), nanoscale photoluminescence (PL) properties were measured for the NWs. Nanoscale optical DNA sensing without the use of a fluorescent dye was examined using light-emitting P3MT NWs with different dopants. By attaching probe (*p*)-DNA, the luminescence color of the light-emitting P3MT single NW varied from green to red. For a target (*t*)-DNA recognized single NW, a significant increase in PL efficiency was observed without the use of extra fluorescent dyes. This PL enhancement was detectable at *t*-DNA concentrations ranging from 100 aM to 100 nM.[1] The light-emitting color barcode nanowires (LECB-NWs) were prepared by alternating the electrochemical polymerization of light-emitting P3MT, P3BT, and PEDOT with various luminescence colors and efficiencies. The optical detection sensitivity and stability of LECB-NWs have been enhanced through a nanoscale Cu metal coating onto the NWs, based on surface plasmon resonance coupling and protection against oxidation.[2] We also studied the focused electron (E)-beam irradiation techniques that can tailor precisely the optical and structural properties of organic single NW on the nanoscale. Light-emitting P3MT single NWs have been tailored successfully to one-dimensional serial multi-compartments similar to a super-lattice NW with different lengths and characteristics modified precisely through focused E-beam treating conditions. [3] We suggest that light-emitting organic NWs studied here can be promising nanostructures for bio-sensing and optoelectronic nanotechnology, and the focused E-beam treatment as a post-manipulation procedure is a promising technique for fine tailoring of the intrinsic properties of organic nanosystems.

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