Chemoreceptor-Functionalized Interpenetrating Polymer Semiconductor Nanonetwork for Ultrasensitive, Selective, and Fast Recovered Chemodetection

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Organic semiconductors (OSCs) are promising candidates in chemosensor research because they can obtain high sensitive chemodetection at room temperature, attributed to effective contact with target chemicals. However, OSCs cannot serve functionalization sites for selectivity, and exhibits poor recovery property by penetration of chemicals into an OSCs film. Herein, we demonstrate interpenetrating polymer semiconductor nanonetwork functionalized with amine based chemoreceptors (NH_2-IPSN). Due to high dipole moment interaction with NO_2 of the anchored chemoreceptor, the NH_2-IPSN exhibited ultrahigh sensitivity (990% ppm^{-1} at NO_2 5 ppm) and superior selectivity in room temperature operation. Furthermore, the surface NH_2 groups can suppress penetration of NO_2 into the NH_2-IPSN film effectively, so that fully recovery capability with fast recovery rate (240 s) was achieved. We believe that our rational design of OSCs will provide a guidance for realization of practical chemodetection.