

Chemical Sensing Properties of Self-Assembled Film Based on an Amphiphilic Ambipolar Triple-Decker (Phthalocyaninato) (Porphyrinato) Europium Semiconductor

Authors : Kiran Abdullah, Yanli Chen

Abstract : An amphiphilic mixed (phthalocyaninato) (porphyrinato) europium triple-decker complex $\text{Eu}_2(\text{Pc})_2(\text{TPyP})$ has been synthesized and characterized. Introducing electron-withdrawing pyridyl substituents onto the meso-position of porphyrin ring in the triple-decker to ensure the sufficient hydrophilicity and suitable HOMO and LUMO energy levels and thus successfully realize amphiphilic ambipolar organic semiconductor. Importantly, high sensitive, reproducible p-type and n-type responses towards NH_3 and NO_2 respectively, based on the self-assembled film of the $\text{Eu}_2(\text{Pc})_2(\text{TPyP})$ fabricated by a simple solution-based Quasi-Langmuir-Shäfer (QLS) method, have been first revealed. The good conductivity and crystallinity for the QLS film of $\text{Eu}_2(\text{Pc})_2(\text{TPyP})$ render it excellent sensing property. This complex is sensitive to both electron-donating NH_3 gas in 5-30 ppm range and electron-accepting NO_2 gas 400-900 ppb range. Due to uniform nano particles there exist effective intermolecular interaction between triple decker molecules. This is the best result of Phthalocyanine-based chemical sensors at room temperature. Furthermore, the responses of the QLS film are all linearly correlated to both NH_3 and NO_2 with excellent sensitivity of $0.04\% \text{ ppm}^{-1}$ and $31.9\% \text{ ppm}^{-1}$, respectively, indicating the great potential of semiconducting tetrapyrrole rare earth triple-decker compounds in the field of chemical sensors.

Keywords : ambipolar semiconductor, gas sensing, mixed (phthalocyaninato) (porphyrinato) rare earth complex, Self-assemblies

Conference Title : ICCBE 2018 : International Conference on Chemical and Biological Engineering

Conference Location : Venice, Italy

Conference Dates : April 12-13, 2018