Hybridization Between Conductive Polymers and Topological Covalent Organic Framework Toward Exotic Physicochemical Properties

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Covalent organic frameworks (COFs) have attracted much attention as functional porous crystalline polymers with periodic structures, formed by robust covalent bonds. To achieve high electrical conductivities, we obtained a hybrid material of conductive polymer, poly(3,4-ethylenedioxythiophene) (PEDOT), and redox-active AQ-COF[1] (Fig. 1(a)) by performing a facile in-situ polymerization in void space of COFs.[2] However, both the EDOT/AQ-COF mass ratio dependence of conductivity and the conducting mechanism have not been reported. Here we will demonstrate the properties of PEDOT@AQ-COF in electrical conductivity, cyclic voltammetry (CV), and electron spin resonance (ESR), varying with the mass ratio of EDOT monomer and AQ-COF from 1.35 to 2.25. The electrical conductivity showed 100 times jumping between 1.65 and 1.80 of mass ratio (Fig. 1(b)), and the corresponding CV curves exhibit the 10 times enhancement in the capacity. In addition, upon increasing the mass of EDOT, we found that the peak-to-peak distance of the ESR signal changes from a symmetric narrow line to a broad line, at the same critical point as discussed in the conductivity measurements.

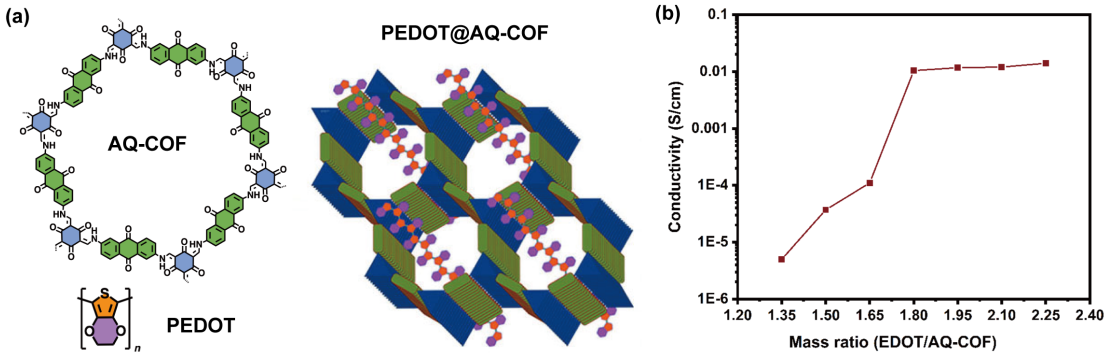

Fig. 1. (a) Chemical structure of AQ-COF and PEDOT, and schematic image of PEDOT@AQ-COF, (b) mass ratio dependence of conductivity of PEDOT@AQ-COF.

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