

Polymeric Chalcogenides as High-Performance Electrocatalysts for Dye-Sensitized Solar Cells

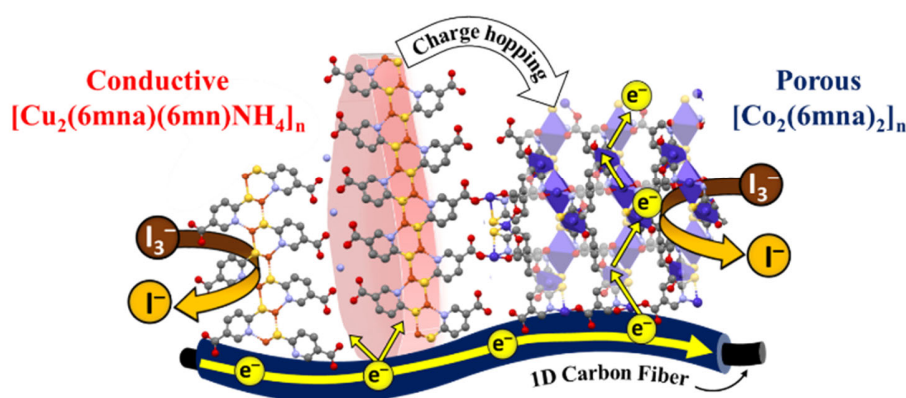
Chun-Ting Li*

Department of Chemistry, National Taiwan Normal University, Taipei, Taiwan

*Corresponding author's email: ctli@ntnu.edu.tw

Polymeric chalcogenides, including $[\text{Cu}_2(6\text{mna})(6\text{mn})\text{NH}_4]_n\text{-NO}_3$, $[\text{Co}_2(6\text{mna})_2]_n\text{-NO}_3$, $[\text{Co}_2(6\text{mna})_2]_n\text{-Cl}$, $[\text{Cu/Co}(6\text{mna})_2]_n\text{-NO}_3$, $[\text{Cu/Co}(6\text{mna})_2]_n\text{-Cl}$ (6mna= 6-mercaptopnicotinic acid; 6mn= 6-mercaptopnicotinate), silver bezeneselenolate ($[\text{Ag}_2(\text{SePh})_2]_n$; mithrene), and PEDOT-PEDTT (PEDOT= poly(3,4-ethylenedioxythiophene); PEDTT= poly(3,4-ethylenedithiophene)), were newly introduced as the electro-catalysts for the counter electrodes in dye-sensitized solar cells (DSSCs).^[1-2] By using a ligand-assisted hydrothermal method, a metal-assisted hydrothermal method, or an electro-deposition method to achieve the bottom-up film growth, all the polymeric chalcogenides films were covalently bonded to a conducting substrate of carbon cloth (CC) to deliver their intrinsic electro-catalytic ability without any additives. In an I^-/I_3^- electrolyte, the DSSCs coupled with all the CC/(Cu/Co)-MOF electrodes showed a superior solar-to-electricity conversion efficiency (9.4%~10.0%) than the cell with the traditional CC/Pt electrode (9.3%), demonstrating their outstanding electrochemical activities. In a $[\text{Cu}(\text{dmp})_2]^{2+/1+}$ (dmp= 2,9-dimethyl-1,10-phenanthroline) electrolyte, the DSSCs coupled with the CC/AgSePh-30 (10.2%) and CC/PEDTT-50 (10.4%) electrodes both outperformed the CC/Pt electrode (7.43%), indicating the significant of inserting electron-donating S/Se atoms for increasing defects/active sites, adjusting a suitable energy band structure, and creating low-dimensional charge transfer routes. This work shed the light on the future design and synthesis in Cu-complex (or iodide) mediators and functional polymeric chalcogenides for high-performance DSSCs.

Synergetic bimetallic $[\text{Cu/Co}(6\text{mna})_2]_n$ electro-catalyst



References:

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