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TROUGH-BOND APPROACH ENHANCED CONDUCTIVITY OF A POROUS METAL-ORGANIC COORDINATION POLYMER: HIGHLY ELECTROCHEMICAL-REVERSIBLE ELECTRODE SUPERCAPACITOR PERFORMANCE

Next generation materials for electronic-electrochemical applications are expected to move on from purely inorganic towards organic and hybrid inorganic-organic materials, because inorganic materials have clear drawbacks such as scarcity of usable inorganic ions and limited tailoring of structural design. Metal-Organic Coordination Polymers (MOCPs) are self-assembled crystalline materials which are constituted of metal ions or metal clusters coordinated with organic bridging ligands forming defined framework structures. These materials are easily designed with tailorable structures and functional tunability due to its molecular nature. Despite these interesting features, in general, the vast majority of metal-organic coordination polymers are insulators and exhibit very low electrical conductivity. An approach to enhance the electronic properties of metal-organic coordination polymers is to improve the orbital overlap in the coordinate bond between the ligand and the metal ions (through-bond approach). In this research work, a novel Porous Metal Organic Coordination Polymer, named Co-BDBA, was synthesized. To synthesize Co-BDBA, Benzene-1,4-diboronic acid and Cobalt were used as linker and metal center, respectively. Co-BDBA possess an energy gap (Tauc plot) of 3.41 eV, then, this material might be classified as a semiconductor. To take advantage of the semiconductor feature, Co-BDBA was investigated as a possible Supercapacitor electrode. Electrochemical outcomes indicate that this metal-organic coordination polymer has a pseudocapacitive behavior, showing two redox reactions, and its charge-discharge mechanism is controlled by surface processes. The most remarkable feature of Co-BDBA as a supercapacitor electrode is that, after 2000 galvanostatic charge-discharge cycles, it presents a capacitance retention of ~110 %, due to its high electrochemically reversibility, better than previously reported coordination polymers.

Keywords

Semiconductor, supercapacitor, metal-organic, electrochemical-reversibility

Reference

Tang X, Zhang Y, Sun W, Wang Y. Carbonyl functional group modified metal–organic coordination polymer with improved lithium-storage performance. ACS Appl Energy Mater. 2020 Nov 23;3(11):11378–87

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