Naphthalene Diimide-Based Semiconducting Porous Coordination Polymers for Efficient Chemiresistive Gases Sensing

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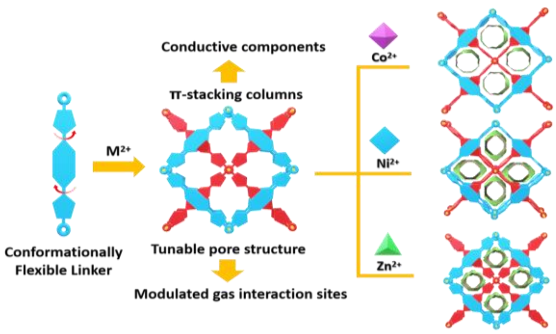
A chemiresistor is a sensing material that changes its electrical resistance in response to the chemical environment. Conventional chemiresistor show low specific surface area and lack of the interaction sites with gases, resulting in poor selectivity, high operating temperature, and high-power consumption for gas sensing.[1] As promising candidates for advanced chemiresistive materials, semiconducting porous coordination polymers (PCPs) have attracted considering attention, owing to their high affinity for gas.[2] However, accurately regulating both the conductivity and pore structure to create specific recognition and response is challenging. To overcome these problems, we propose a strategy of “ligand conformational control” to realize subtle tunability of pore environment and conductivity, obtaining a series of semiconducting PCP suitable for sensing.

Three conjugated PCPs (Co-pyNDI, Ni-pyNDI, and Zn-pyNDI) were obtained by assembling conformationally flexible bipyrazole-appended naphthalene diimide linkers (pyNDI) with corresponding metal ions.[3] The π-stacking distances and ligand conformation in these isoreticular PCPs were modulated by altering metal coordination geometries as verified by three-dimensional electron diffraction (3D ED), resulting in tunable pore structure and conductivity. As a result, selective chemiresistive sensing at room temperature was achieved using the PCP-based chemiresistors. Details of syntheses, structures, and chemiresistive sensing studies will be presented.



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