Abstract

Improvements in the fields of chemistry, physics and engineering have allowed better understanding of the structure-property relationships. As a result, many efforts have been made to precisely control the composition, the structure and the properties of materials to develop numerous fields such as photovoltaics, batteries, energy conversion, energy storage and nanotechnology, and so forth. Functional materials have therefore significant impacts on our lives styles such as energy, transportation, life science and environment. Increasing efficiency and improved reliability of promising technologies can then be achieved by the design of new materials.

Attempts to construct valuable materials must overcome two main challenges: (i) the starting components must be selected to have suitable individual properties; and (ii) the topology and functionality of the components must allow controlling the organization of each single atom in the material. In this context, the need for new materials capable of efficiently storing and converting renewable energies is essential. Coordination polymers are one of the advanced classes of materials for such applications due to their versatile structures and properties depending on organic and inorganic moieties. In this study, we have designed a series of isostructural two-dimensional Metal-Organic Polymers (MOP) using a rich N-polyaromatic ligand with various metals to produce materials that are valuable for solar cells, batteries, sensors and optoelectronic applications. MOPs prepared with our approach exhibit reversible chromic behaviours confirmed by single-crystal and powder X-ray diffraction, Fourier transform infrared spectroscopy and solid-state UV-Vis spectroscopy. They also show interesting bandgaps for light harvesting as determined by theoretical calculations. To explore the isostructurality of MOPs, we incorporated two different metals into a structure to create Mixed Metal-Organic Polymers (MMOPs). The addition of various metals in the same structures allows us to tune and improve the properties of materials.