
Defective metal organic frameworks fabricated by the steric hindrance effect of anions for the application of coatings

Yue Zhao*, Jin-Wei Zhang, Li Wang, Ji-Yong Zheng and Cun-Guo Lin*
National Key Laboratory of Marine Corrosion and Protection, Luoyang Ship Material Research Institute, Qingdao, 266237, China

Yue Zhao: zhaoyue@sunrui.net ; Cun-Guo Lin: lincg@sunrui.net

Abstract In this work, a versatile strategy of defective metal organic frameworks (MOFs) manipulated with the assistance of the steric hindrance effect was proposed and applied in anticorrosion and antifouling coatings. The steric hindrance effect was utilized to construct the defective zeolite imidazole frameworks (ZIFs) by phosphate, gluconate and phytate as classic examples. The defective MOFs, Phosphate-ZIF-7, Gluconate-ZIF-7 and Phytate-ZIF-7, were successfully synthesized by de novo method. The preparation process of defective ZIFs was environmentally friendly in aqueous solution at room temperature. The anions with different steric hindrances have an impact on the morphology and structure of defective MOFs, which can be tailored to form spherical, lamellar, or irregular shapes. As the steric hindrance of anions gradually increases, the absolute value of zeta potential gradually increases, elaborating that the stability of defect-engineered ZIF-7. The as-tailored defects in nanoparticles make the molecular chains of polymers permeate into the internal skeleton to form the interlocking structure, improving the comprehensive properties of coatings at molecular level. The mechanical properties of waterborne acrylic resin were improved remarkably after embedded with defective ZIF-7. The defective MOFs were added in waterborne acrylic resin to improve the corrosion protection performance. The structure-property relations were elaborated by molecular dynamics simulation and relevant experiments in detail.