ABSTRACT

This dissertation presents the syntheses and characterizations of triply ferrocene-bridged boroxine cyclophane, fluorinated metal-organic frameworks and noncovalent organic framework, metal-macrocyclic frameworks, and the host-guest chemistry of the macrocycle. A procedure for the production of 3D models of crystal structures is reported as well.

Chapter One. This chapter summarizes previous work and applications on porous materials such as metal-organic frameworks, covalent organic frameworks, and crystalline noncovalent organic porous materials.

Chapter Two. The syntheses of ferrocene-based ligands as building blocks for MOF construction and the synthesis of triply ferrocene-bridged boroxine cyclophane are presented.

Chapter Three. This chapter describes the syntheses and characterizations of six perfluorinated metal-organic frameworks as well as their superhydrophobic properties and unique adsorption behaviors.

Chapter Four. The synthesis and characterization of a perfluorinated noncovalent organic framework and its exceptional affinity for fluorocarbons and Freons are discussed.

Chapter Five. The use of shape-persistent dehydrobenzannulene macrocycles for the syntheses of Zn- and Zr-based metal-macrocyclic frameworks is presented. The host-guest chemistry of the macrocyles with fluorinated arenes is also studied.

Chapter Six. Step by step procedures for the production of 3D models of crystal structures and pictorial examples of 3D printed models are displayed.