Microporous materials, which have pores with diameters less than 20 Å, are attractive in both industry and scientific fields since they are applicable for gas separation, gas adsorption, and catalysis. I previously reported a porous single crystal of a metal complex \([\text{Cu}_2(\text{bza})_4(\text{pyz})]_n\) \(I\), which has structural flexibility as well as regularity. The single crystal \(I\) easily adsorbed various gases through narrow channels with a diameter of ca. 2-4 Å. While the design of sorption selectivity in porosity is mostly based on pore structure and adsorption interaction, flexibility can enable tuning the adsorption state by adjusting the host structure. To develop the dynamic gas selectivity, three kinds of separation for various organic vapors and inorganic gases were carried out for \(I\): (1) chromatography on a microporous packed column, \(2\) sorption from a vapor mixture, \(3\) permeation through single crystal of for various organic vapors and inorganic gases. \(3\) The analyses of these results demonstrated the novel dynamic separation on flexible porous solid: (1) strong entropy dependence, \(2\) dynamic switch of gas selectivity, and \(3\) smooth and high selective permeation through narrow channels.


Keywords: gas-solid inclusion reactions, adsorption kinetics, solid-state phase changes

In the formation of mesoporous silica materials with surfactants, the interaction between inorganic species and surfactants plays a crucial role. The mesoporous materials commonly form a kind of interface which minimises the system shows a good example of synthesizing mesostructures by controlling the interface curvature.

The minimum surfaces also appear in crystalline inorganic phases, especially for those with extra large pores, such as the germanate SU-M.[2] ITQ-37, a germanosilicate zeolite, is another example with its pore-size approaching the meso-scale.[3] Its structure was determined by a new approach: combining selected area electron diffraction (SAED) and powder X-ray diffraction (PXRD) in a charge-flipping algorithm. The framework of ITQ-37 follows the srs minimal net and its extra-large 30-rings form two unique cavities where each cavity is connected to three others to form a gyroidal channel system. These cavities describe the enantiomorphous srs net of the framework. Different from all known MCM-48-type mesostructures and other microporous structures, ITQ-37 is the first chiral zeolite with one single gyroidal channel and this channel is roughly separated from the framework by a G-minimum surface. It has the lowest framework density (10.3 Å⁻³) of existing 4-coordinated crystalline oxide frameworks, and the pore volume of the corresponding silica polymorph would be 0.38 cc.g⁻¹.


Keywords: porous materials, minimum surface, topology

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In the formation of mesoporous silica materials with surfactants, the interaction between inorganic species and surfactants plays a crucial role. The mesoporous materials commonly form a kind of interface which minimises the surface energy. It is quite often to see the silica wall follows so-called bi-continuous minimum surfaces, while no real example was found to present a tri-continuous minimum surface although it was predicted mathematically. IBN-9 is the first example which shows a tri-continuous pore structure with its pore-size approaching the meso-scale.[3] Its structure was determined by a new approach: combining selected area electron diffraction (SAED) and powder X-ray diffraction (PXRD) in a charge-flipping algorithm. The framework of ITQ-37 follows the srs minimal net and its extra-large 30-rings form two unique cavities where each cavity is connected to three others to form a gyroidal channel system. These cavities describe the enantiomorphous srs net of the framework. Different from all known MCM-48-type mesostructures and other microporous structures, ITQ-37 is the first chiral zeolite with one single gyroidal channel and this channel is roughly separated from the framework by a G-minimum surface. It has the lowest framework density (10.3 Å⁻³) of existing 4-coordinated crystalline oxide frameworks, and the pore volume of the corresponding silica polymorph would be 0.38 cc.g⁻¹.


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