

Microporous Polymers and Conjugated Polymer Networks

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Abstract – Microporous polymers combine the high surface areas of inorganic materials with the variability of the organic and polymer chemistry. Based on specially designed monomers we synthesized porous polymer networks with surface areas up to 1250 m²/g. Depending on the functional groups different reaction routes can be used and polymers can be obtained either by homo or copolymerization. The accessibility of the pores makes those porous networks interesting as catalyst support, for gas storage and electronic devices.

Microporous materials with very high surface areas are of considerable interest for fundamental research and industrial applications. Based on organic compounds, these materials combine the high surface areas and low densities of inorganic materials like zeolites or activated carbons with an excellent control of the chemical and physical properties known from organic synthesis.

We synthesized microporous polymer networks with surface areas up to 1250 m²/g composed of purely organic materials. Porosity is created by using specially designed molecular architectures as 3D tectons and by generating stiff, covalent bonds between them. Two suitable tectons are 9,9'-spirobifluorene or tri-substituted benzene. Different reaction routes, such as oxidative polymerization, Suzuki coupling or Yamamoto coupling can be used to connect these monomers into stiff polymer networks, exhibiting zeolite-like porosity and surface areas. Due to this different reaction types either homopolymers are obtained or by adding a second monomer copolymerisation is achieved. Through this approach a large variety of different functionalities can be easily incorporated into the porous polymer networks. The pores are accessible for gases, small organic molecules and metal ions. Thus metal nanoclusters can be created in the pores and the resulting polymer/metal nanocomposite shows a high catalytic activity in the hydrogenation of diphenylacetylene. Depending on the used monomers conjugation length, pore size and functionalities in the pore walls can be varied easily. This, in combination with the accessibility of the pores makes those porous polymer networks interesting as catalyst support, electronic devices and for gas storage or separation.

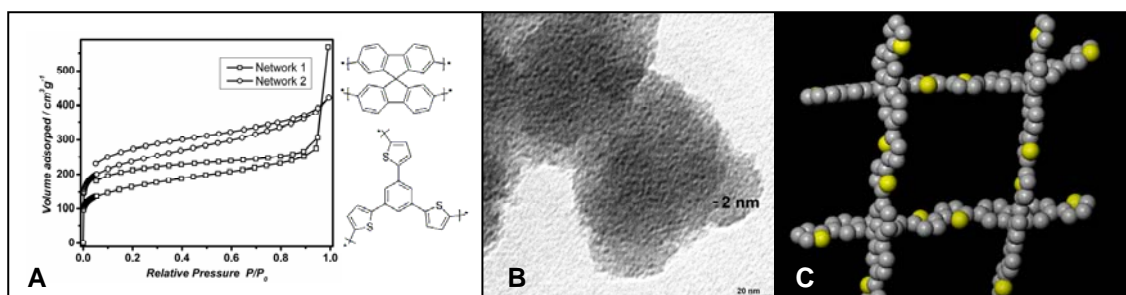


Figure 1: (A) Nitrogen sorption isotherm of two porous polymer networks based on different tectons. (B) TEM picture of palladium nanoclusters in the pores. (C) Scheme of ideal network structure based on 9,9'-spirobifluorene

References

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