IBS Center for Multidimensional Carbon Materials

CMCM Colloquium

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Chemistry in the confined spaces of porous polymers and the rough road for porous diamond

Tuesday, May 3
1:15 pm

Bldg 101
Seminar room on the 1st floor

Porous polymers with rigid organic structures through a covalent backbone feature permanent voids that can be used for chemical activities. We have developed a family of nanoporous (pore size < 100 nm) covalent organic polymers (COPs), which show significant capacities and selectivities for gases (e.g. CO_2), and water contamination (e.g. heavy metals). We've shown that azo (N=N) bearing COP-68 show lack of N_2-philicity by increasing temperature, in other words N_2-phobicity, leading to very high CO_2/N_2 selectivities. Under high pressures COP-1 shows a record high capacity of 5.6 g/g CO_2 uptake at high pressures. COP-83 has a capacity of 5 mmol/g at 298 K and 1 bar, and COP-97 shows an uptake of 8 % (w/w) CO_2 in 2 minutes from a simulated flue gas mixture. More recently, we introduced ethylene diamines on the walls of COP-115 through bromination intermediates, providing tunability in binding energy. In COP-122, we controlled spherical morphology and converted nitrile pendant groups to amines for further grafting chemistry. COP-150 is scalable into kg and provides a hydrocarbon backbone for post-modification. Order in porous polymers can be achieved through dynamic covalent chemistry, a source of instability. We've sought to use irreversible binding through charged substituent guiding for systems like porous diamond. After numerous failed attempts, our approach is now to lock directional growth in order to achieve ordered assembly.

References: Patel et al., *Chem. Mater.* 26 (23), 6729–6733 (2014), *Chem. Eur. J.*, 20, 772-780, (2014), *Nature Commun.*, 4:1357, (2013), *Adv. Funct. Mater.*, 23, 2270–2276 (2013), *J. Mater. Chem.*, 22, 8431-8437 (2012), *Chem. Comm.*, 48 (80), 9989–9991 (2012).

You are cordially invited to attend!