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Smart adsorbents for gas separation research at Australian Synchrotron

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Zeolite molecular sieves are one of the most important materials for separation of molecules. We discovered smart porous materials for gas separation – zeolites containing cations that function as molecular trapdoors allow guest-selective, size-inverse separations. For example, a “molecular trapdoor” mechanism in specifically tailored zeolites which produces a counter-intuitive size-inverse “sieving” for CO/N₂, and a record high selectivity for CO₂/CH₄ separation over a large pressure range. [1] In the other case, we found an unusual operating regime on a chabazite zeolite in which the adsorption selectivity for N₂ over CH₄ inverts from being more selective for N₂ at 253 K, to becoming less selective with increasing temperature and eventually becoming selective for CH₄ over N₂ above 293 K. [2] These materials could benefit for carbon capture and gas purification.

[1] Shang, Jin; Li, Gang; Singh, Ranjeet; Gu, Qinfen; et al. JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, 134, 46, 19246-19253, (2012)

[2] Shang, Jin; Li, Gang; Gu, Qinfen; et al. CHEMICAL COMMUNICATIONS, 50, 35, 4544-4546, (2014)

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Summary

Primary author(s) : Dr GU, Qinfen (Australian Synchrotron)

Co-author(s) : Dr LI, Gang (The University of Western Australia); Dr SHANG, Jin (Melbourne University)

Presenter(s) : Dr GU, Qinfen (Australian Synchrotron)

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