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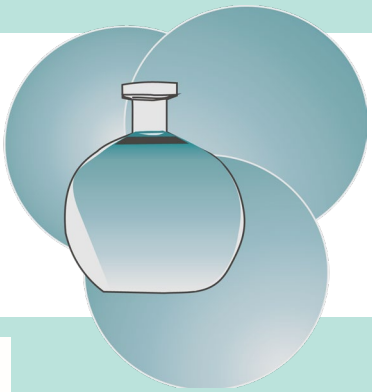

lädt ein

gemeinsam mit der Gesellschaft Deutscher Chemiker zum

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GESELLSCHAFT DEUTSCHER CHEMIKER

Vortrag

von Herrn

Dr. Florian Auras

Technische Universität Dresden

“Organic frameworks as a materials platform for spin-optoelectronics”

am: **Mittwoch, 12.02.2025**

um: 13:30 Uhr

wo: im Raum 1/232

Gäste sind herzlich willkommen!

TECHNISCHE UNIVERSITÄT
IN DER KULTURHAUPTSTADT EUROPAS
CHEMNITZ

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Organic frameworks as a materials platform for spin-optoelectronics

Crystalline and porous organic polymers, also known as covalent organic frameworks (COFs), provide a powerful platform for designing multifunctional materials with precisely tuneable structural, optical and electronic properties.[1-4]
While most COFs are rigid frameworks with static structural and optoelectronic properties, we have recently developed *dynamic* 2D COFs that can be switched reversibly between two or more phases of the same topology but different unit cell parameters and porosities (Figure 1a).[5] The key design update here was to introduce a controlled degree of flexibility by interconnecting rigid π-stacked molecular columns with non-stacked, flexible bridges. This allows the COFs to open and close their pores upon uptake or removal of guests while fully retaining their crystalline long-range order. Further improvements of the COF design have yielded frameworks that show stepwise phase transformations between their respective contracted-pore and open-pore conformations with up to 85% increase in unit-cell volume (Figure 1b).[6] This variable geometry provides a handle for introducing stimuli-responsive optoelectronic properties. As an example, we have demonstrated that the COFs can be toggled between excimer-forming H-aggregates and null-aggregates with monomer-like absorption and emission characteristics. Moving forward, we strive to employ the new materials as scaffolds for spin-quantum bit (qubit) candidates with precise control over their orientation and distances, enabling to investigate geometry-dependent inter-qubit communication.
Our findings reveal general design strategies for dynamic 2D COFs with switchable photophysical properties. The new materials could provide a platform for designing adaptive optical, electronic, and spintronic materials for future applications in quantum information science.

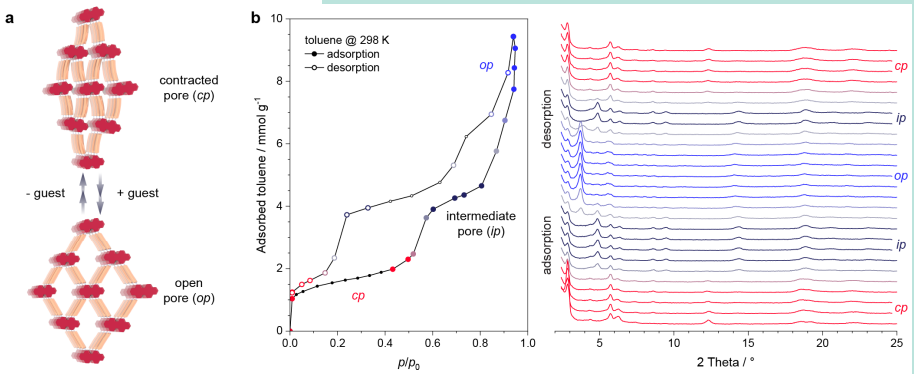

Figure 1. (a) Illustration of a dynamic 2D COF. (b) In-situ powder X-ray diffraction patterns (right) collected during toluene vapour adsorption/desorption (left), showing the step-wise and fully reversible phase transformations of a dynamic 2D COF.

References:
[1] L. Ascherl, *et al.*, *Nat. Chem.* **2016**, *8*, 310. https://doi.org/10.1038/nchem.2444
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[4] D. Bessinger, *et al.*, *J. Am. Chem. Soc.* **2021**, *143*, 7351. https://doi.org/10.1021/jacs.0c12392
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