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INFRAsorp & MULTIport Rapid surface analysis by optical calorimetry

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The assessment of specific surface area and adsorption properties in advanced functional materials is a key task for the characterization of porous materials such as activated carbons, porous polymers, metal-organic frameworks, zeolites, nanoparticles and catalysts. The characterization of porous materials by nitrogen Physisorption at 77 K and gravimetric methods is widely used. However, a major drawback of the methods is that a significant amount of time is required for a single experiment. Especially in time critical applications like delivery- or production control or for material screening applications, a fast characterization method would be desirable.
For this particular application, we introduce the approach of optical adsorption calorimetry. It measures the time-resolved temperature change (thermal response) of a porous sample, which occurs during adsorption of a test gas due to the release of heat of adsorption [1,2]. The magnitude of temperature change depends on the heat capacity of the material, the number of adsorbed molecules; the amount of heat released by each molecule, the speed of adsorption as well the heat transfer properties (convection, conduction, radiation) within the sample and the optical calorimeter.
The INFRAsorp is the optical calorimeter tool for a high throughput adsorption screening, developed by Fraunhofer IWS. Additionally, the advanced MULTIport device is available. It enables automatic measurements of up to 12 samples and different adsorptives. It is suited for various test gases like n-butane, VOCs, CO2, H2S and H2O among others [3]. Other advantages of the technique are the small sample size (< 30 mg), that no cooling or liquid nitrogen is required due to measurement at 298 K and the small footprint and compact design of the device.

References

[1] P. Wollmann, M. Leistner, U. Stoeck, R. Grünker, K. Gedrich, N. Klein, O. Throl, W. Grählert, I. Senkovska, F. Dreisbach and S. Kaskel, "High-throughput screening: speeding up porous materials discovery,"Chemical communications (Cambridge, England), vol. 47, no. 18, pp. 5151-5153, 2011.
[2] P. Wollmann, M. Leistner, W. Grählert, O. Throl, F. Dreisbach and S. Kaskel, "Infrasorb: Optical detection of the heat of adsorption for high throughput adsorption screening of porous solids,"Microporous and Mesoporous Materials, vol. 149, no. 1, pp. 86-94, 2012.
[3] M. Wöllner, N. Klein and S. Kaskel, "Measuring water adsorption processes of metal-organic frameworks for heat pump applications via optical calorimetry,"Microporous and Mesoporous Materials, vol. 278, pp. 206-211, 2019.

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