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Thermoporometry as an alternative method for porosity characterization

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Thermoporometry (TPM) is considered to be a promising alternative method for the porosity characterization in a wet state, concretely meso- and macroporosity. Knowing the porosity of the studied samples from wet state has some advantages, especially upon application e.g. in wastewaters treatment. TPM method is based on depression of the melting/freezing temperature of a liquid entrapped in pores. Since TPM is a really simple to use, it is almost unused. The problem is probably connected with the conversion of DSC signal to pore size distribution (PSD) which is based on Gibbs-Thomson equation together with the concept of non-freezable pore water (δ). In the case of small mesopores, the value of δ is really crucial, and also dependent on chemical nature of the sample, temperature and its determination is not so easy. On the other hand, for large mesopores (approx. >20nm), the δ value influences calculated pore size only minimally, but in this case the melting/freezing of pore and bulk liquid (e.g. water) is merged together, and the further porosity characterization is almost impossible. Nevertheless, in our previous study we proved, that the deconvolution of the merged melting peaks makes from the TPM method universal method for the whole mesoporous range based on water as a probe liquid, enjoying all its advantages (high heat of fusion, quick and cheap measurement, samples in wet state). Thus, the main aim of this contribution is to show applicability and possible usage of TPM method for the porosity characterization of various materials, such as MOFs, carbons, or hybrid materials.

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