CARPOR
Characterization of Porous Materials

POROSITY

Porosity is an important parameter to describe the internal structure of materials and often has a great impact on their characteristics, behavior or performance. Therefore, porosity is important in many industrial sectors, such as petrochemistry, heterogeneous catalysis, pharmaceutics, metallurgy, construction materials and energy storage.

Among the metrics of interest, we can cite the void fraction, the density, the pore size distribution, the total pore volume and the pore surface area. Depending on the application, average values can be sufficient, whereas in other cases, a precise determination of the pore sizes are necessary.

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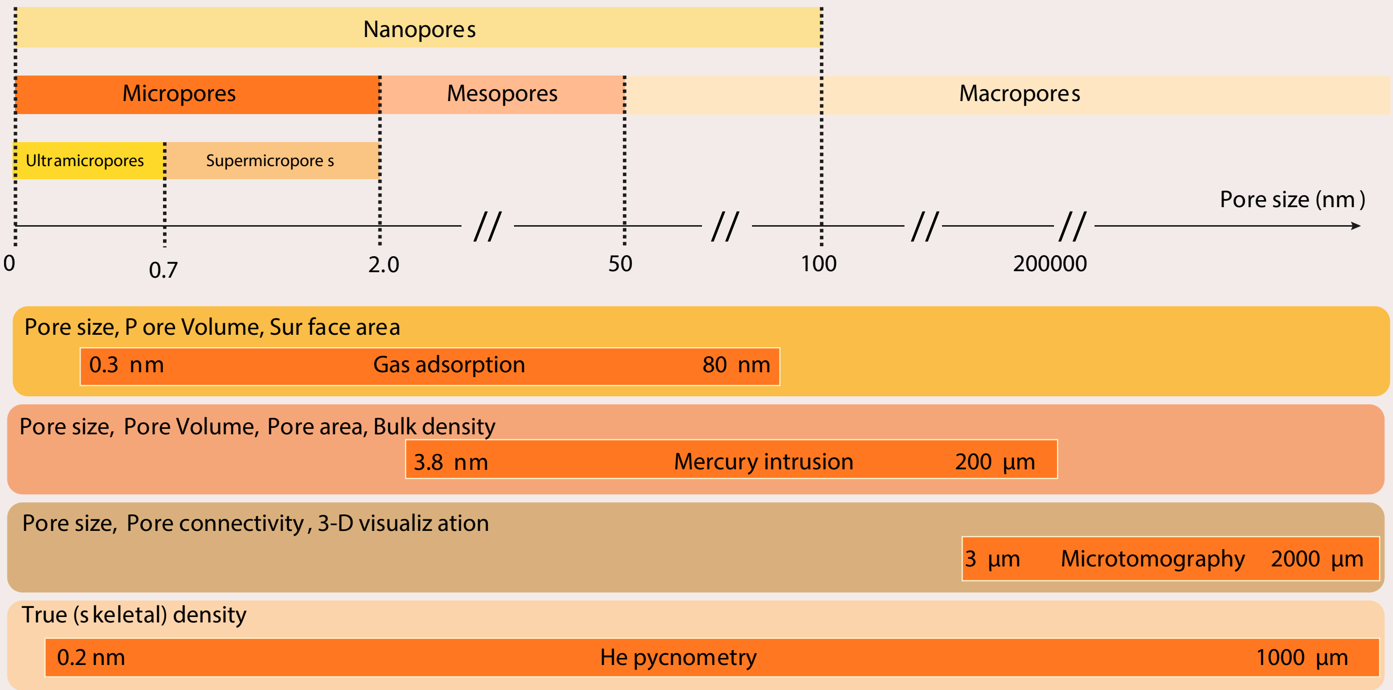
Pore sizes are usually classified in three ranges, which are micropores (< 2.0 nm), mesopores (2.0-50 nm) and macropores (> 50 nm). In some cases, an additional distinction is made between ultramicropores (<0.7 nm) and supermicropores (0.7-2 nm), whereas pore sizes lower than 100 nm can be qualified as nanopores.



Given this wide range, there is no single technique that allows to cover all the pore sizes. CARPOR proposes a series of techniques that can, individually or combined, provide information over a wide range of porosities. Micro- or mesoporous materials will preferentially be characterized by gas adsorption measurements and meso- or macroporous materials by mercury intrusion porosimetry. A direct internal view in the micrometer-range can be performed with X-ray microtomography.

Density is also an important parameter that will influence the behavior of materials. CARPOR provides the possibility to investigate the true (skeletal) density of materials by gas displacement pycnometry, whereas the bulk density at different pressures can be determined by mercury intrusion porosimetry. Combination of both these techniques give access to the percentage of porosity of a material (Porosity = [1- Bulk density/True density x100]).

Porosity also affects the way materials will behave in terms of humidity uptake along with other thermophysical properties. Relationships between such behaviors and porosity can be established by combining the above-mentioned techniques with Dynamic Vapor Sorption, Moisture analysis and TG-DSC techniques available at the CARPOR platform.

Wallonie

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