Interference and IR-Microscopy for Studies of Nanoporous Materials: An Insightful View on Intracrystalline Molecular Transport

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The theoretical understanding of intracrystalline molecular transport is essential for designing and optimizing nanoporous materials for their diverse applications. Therefore it is indispensable to know how the molecular transport is influenced by the real (non-ideal) structure of these materials. The techniques of interference and IR microscopy provide two powerful tools which enable to assess directly the mechanisms of mass transfer of molecular ensembles in nanopores by obtaining time- and space-resolved images of the concentration of guest molecules within the host material [1-4].

Interference microscopy is based on the following principle: The change of the local refractive index of the nanoporous host system is proportional to the local change of the number of guest molecules residing in the pore system. This allows the straightforward determination of concentration integrals as a function of the position in the plane of observation [3,4].

The rapid technical development of FTIR microscopy within the last few years enabled its use for studying the sorption kinetics in nanoporous materials spatially- and time-resolved. For this purpose, a focal plane array (FPA) detector with 128 x 128 pixels comes into operation, recording 16384 single IR spectra. Following the intensity of characteristic IR absorption bands of guest molecules leads directly to concentration maps representing the distribution of molecules within the host material.

In parallel with a detailed introduction into these two complementary imaging techniques, we are going to present the results of a study of water ad- and desorption in CrAPO-5 and SAPO-5 crystallites with new insights into the real structure of these materials [5].

References

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