Though diffusion is well-known to be among the rate limiting phenomena in numerous technical processes based on the application of nanoporous materials, our knowledge about molecular mass transfer in such systems is still far from complete. The advent of the techniques of “microimaging” could thus, over the last few years, give rise to a remarkable gain in our knowledge in this field. After an introduction into the various types of experiments by which molecular diffusion may be recorded, special emphasis shall be given on the novel evidence on mass transfer attainable with the application of interference and IR microscopy for “microimaging”. These options include the quantitation of transport resistances on the external surfaces of the particles which in numerous cases are found to notably exceed the diffusional resistance of the genuine pore network, the measurement of intracrystalline diffusivities with unprecedented reliability as a standard for predictions by molecular modelling, transport assessment in pore space hierarchies, the simultaneous observation of the fluxes of different components including “uphill” diffusion and “overshooting” and the recording of transient concentration profiles with the option of the one-shot determination of the effectiveness factor of chemical reactions.

Jörg Kärger got his PhD in Physics in 1970 at Leipzig University, followed by habilitation in 1978. In 1994 he became Professor of Experimental Physics and head of the Department of Interface Physics in Leipzig. He served as Dean of the Faculty of Physics and Earth Sciences at Leipzig University (1996 – 1999), President of the German Zeolite Association (1996 – 1999) and Ombudsman of Leipzig University (2002 – 2006). His research activities, unabatedly continued after retirement in 2009, are dedicated to diffusion phenomena and novel techniques of their measurement. They gave rise to the establishment of the Diffusion Fundamentals online journal and conference series. His book on Diffusion in Nanoporous Materials (Wiley-VCH, 2012), co-authored by Douglas Ruthven and Doros Theodorou, became standard in the field. His activities were recognized, among others, by the Donald W. Breck Award for zeolite research, the Max Planck Research Prize and election to the Saxon Academy of Sciences.

Monitoring adsorption, diffusion and reaction through the microscope: the novel options of microimaging

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