

Controlled porosity of MCM-41 obtained by partial blocking of pores by silicon oil

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Partial blocking of mesopores in the ordered MCM-41 silica by DC550 silicon oil was proposed as a preparation method of the material with controlled porosity and fixed pore size. The porosity of the samples with various content of DC550 was examined with the use of low temperature nitrogen sorption and positron annihilation lifetime spectroscopy (PALS). It was shown that the oil is good wetting agent for MCM-41 silica. It blocks the primary pores by forming the plugs near its entrances, but also partially locates in the interparticle spaces, especially when primary pores are almost completely filled.

The comparison of the results obtained from both investigation techniques was used to make the first attempt to obtain the calibration (Fig.1) of ortho-positronium intensity, depending on pore volume. This is necessary to improve the utility of PALS as a porosimetric technique. The need to take the migration of positronium to larger free volume into account is discussed. Two proposed curves refer to the situation, when all primary pores are either open (solid line) or closed (dashed line). In most probable case, a fraction of pores is closed, but other fraction remains open, which refers to the area between these curves. One should be noticed, that the calibration could depend on the pore diameter and particular settings of PALS spectrometer. This requires further examination.

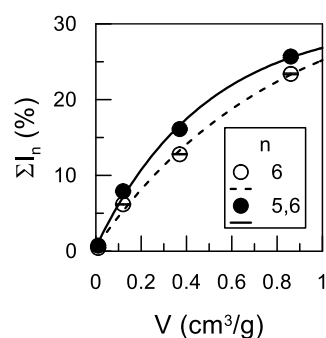


Fig.1 The relation between intensity (I_n) of the components originating from pores of MCM-41 and the total pore volume from nitrogen adsorption.