Functional Materials **7**, No.3 (2000) © 2000 — Institute for Single Crystals

Behaviour of 4-pentyl-4'-cyanobiphenyl nematic liquid crystal in nanopores of Me^{2+}MCM-41 molecular sieves

T.Gavrilko, I.Gnatyuk, G.Puchkovskaya, Yu.Goltsov*, L.Matkovskaya*, A.Kolbe*

Institute of Physics, National Academy of Sciences of Ukraine, 46 Nauki Ave., Kyiv 03039, Ukraine
*Institute of Physical Chemistry, National Academy of Sciences of Ukraine, 31 Nauki Ave., Kyiv 03039, Ukraine
**Institute of Physical Chemistry, Martin-Luther-University, 2 Kurt-Mothes-Str., Halle (Saale) 06099, Germany

Investigation results of IR absorption spectra have been presented for unmodified aluminosilicate mesoporous molecular sieves (MCM-41 type, channel diameter 40 Å) and the same sieves modified by bivalent metal ions (MeMCM-41), as well as for those loaded with 4-pentyl-4'-cyanobiphenyl nematic liquid crystal (LC). The main changes in the "host" and "guest" compounds spectra are shown to be caused by the interaction of some liquid crystal molecules with active centers of the channel surface and Me^{2+} ions. The relative amount of liquid crystal molecules encapsulated in "liquid crystalline" state and those involved in the interaction with the channel surface has been estimated depending on the presence of different Me^{2+} (Co, Ni, Cu) cations and the temperature.

В работе приведены результаты исследования ИК спектров поглощения алюмосиликатных исходных молекулярных сит типа МСМ-41 и модифицированных двухзарядными ионами металлов МеМСМ-41 (диаметр каналов 40Å) и соединений включения с нематическим жидким кристаллом (ЖК)-4-пентил-4'-цианобифенилом (5ЦБ), полученных на их основе. Показано, что основные изменения спектров "матрицы" и "гостя" обусловлены взаимодействием части молекул ЖК с активными центрами поверхности каналов и ионами Me^{2+}. Проведена количественная оценка относительного содержания молекул жидкого кристалла, капсулированных в центральной части каналов пористой матрицы в "жидкокристаллическом" состоянии (в виде димеров) и мономерных молекул, находящихся в приповерхностном слое каналов и взаимодействующих с активными центрами стенок каналов, в зависимости от катионного состава Me^{2+} (Co, Ni, Cu) и от температуры.

It is known that encapsulation of various "guest" compounds into porous matrices of different structure and composition results in formation of inclusion compounds characterized by non-additive combination of physical and chemical properties of the host matrix and encapsulated compound. Recently, a great attention has been given to intermolecular interaction study in different heterogeneous systems containing nematic liquid crystals (LC). It was shown that LC change their physical properties when confined in porous matrices. Mesoporous molecular sieves of different composition including uniformly mesoporous ones like MCM-41 (MCM) and Me^{2+}MCM-41 [1, 2] are regarded as prospective matrices for incorporation of different LC. As compared to zeolites, these sieves have much larger pore diameter (from 40 to 100Å), open pore structure and suitability of inner crystal-