AN EFFECT OF "SCATTERING BY ABSORPTION" OBSERVED IN THE NEAR-INFRARED PROPERTIES OF NANOPOROUS SILICA

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ABSTRACT. The obtained spectroscopic data for absorption and scattering characteristics of nanoporous silica in the wavelength range from 0.25 to 7 μm are analyzed on the basis of the Mie theory. It is shown that aggregates of primary nanoparticles are responsible for relatively high scattering in the short-wave range from 0.25 to 1.4 μm. But the presence of the aggregates and micron-size cracks in the samples cannot explain unusual behavior of scattering in the long-wave part of the spectral range. The work is focused on understanding of strong scattering peaks observed at exactly the same wavelengths as the infrared absorption peaks of bulk silica: at $\lambda = 2.9$, 5.3, and 6.1 μm. The known physical effect of "scattering by absorption" is considered as a source of these scattering peaks. It means that absorption centers are assumed to be not uniformly distributed in the nanoporous matrix but collected in some micron-size regions. The estimates based on this hypothesis are supported by the fact that near-infrared absorption peaks are produced by silanol groups which may be nonuniformly distributed in the hydroxylated nanoporous silica.