

nanoholes. The excitation of SP in Au film of the PCM can further enhance transmission of nanoholes.

The measurements of a single nanohole transmission in PCM have shown that quantitative characteristics of a nanohole transmission (power, orientation, polarization characteristics, etc.) strongly depend on nanohole's dimensions and geometry [23], and therefore the determination of a single nanohole's optical properties should be combined with electron microscopy of the hole.

Illuminated by laser radiation, a single nanohole in a conductive screen is an example of light nanofield realization and has a number of important applications [24]. Microcavity may be used for enhanced light transmission through the nanoholes thus opening the way to multifold by intensity and selective by wavelength signal enhance for a number of applications, such as optical microscopy with nanoresolution, nanolithography utilizing light nanofields [24], quantum information science [25], sensing, data storage and light extraction from LED [26]. Moreover, in our sample second harmonic generation can be demonstrated with an enhanced efficiency: for a given input power, the intensity in the second harmonic can be increased by a factor of 900, since the second harmonic intensity follows the square of the excitation intensity.

By now the largest transmission enhancement reported is $G = 125$ for a single hole with a set of concentric ring grooves, periodically spaced in the radial direction [27] and it is ~ 4 times higher compared to our sample. In the experiment the localization of light field is determined by the diameter of concentric rings encircling the nanohole and ensuring the localization only in submicron range of dimensions. For our sample the spatial localization of light field is determined by the diameter of nanohole used and at its exit is equal to roughly 60 nm, making it possible to form a 2D nanofield with a record-high density of light field localized in nanoscale.

Another interesting perspective of application a photonic crystal microcavity to control transmission of apertures is to use of slits made in metal film of the PCM since for one particular polarization of incident light it can propagate inside slits whatever width of the slits (not cut-off condition): the slits with extremely small thickness can be used, realizing high intensity source of light localized in nm scale (in 1D).

In conclusion let us note the potentialities of the system «nanohole + photonic crystal microcavity». While in this work a microcavity with a fairly moderate Q-factor of ~ 100 was used, the utilization of high-Q cavities with Q-factor of $\sim 10^6$ [28] is a promising prospects for further investigations in the area.

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