

## Nanostructured surfaces

### Impact of the surface water adsorption on nonlinear optical properties of functionalized porous silicon

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In this work the impact of the air humidity on nonlinear optical (NLO) response of porous silicon with oxidized surface was studied.

The sample was placed into the hermetically closed cell with  $\text{CaCl}_2$  that was used for the humidity variation. The experiments were done just before and at different time after closing the cell. The NLO response was studied within the spatial profile analysis technique under the irradiation of picosecond laser pulses at 1064 nm (1.17 eV) that recently was successfully applied for the birefringent mesoporous silicon films studies [1].

It was shown that under the initial conditions (air humidity  $\sim 75\%$  at  $18^\circ\text{C}$ ) the sample demonstrates the self-focusing effect with  $\text{Re}(\chi^{(3)}) \sim 4.1 \cdot 10^{-9}$  esu in peak laser intensity range  $< 50 \text{ MW/cm}^2$ . The reduction of the humidity in the cell and thus the adsorbed water concentration decrease on the sample's surface leads to the refractive NLO response sign turn to self-defocusing. After the long term stay of the sample in the cuvette (dry air conditions) the  $\text{Re}(\chi^{(3)})$  magnitude was established to about  $-4.7 \cdot 10^{-9}$  esu. On the basis of the obtained results we suggest the potential of spatial profile analysis technique application for the water adsorption monitoring at the porous silicon surface.

**1.** Gayvoronsky V. Ya. , Golovan L. A., Kopylovsky M. A., Gromov Yu. V., Zabotnov S. V., Piskunov N. A., Kashkarov P. K., Timoshenko V. Yu. Two-photon absorption and nonlinear refraction of birefringent mesoporous silicon films// Quant. Electron.- 2011.- **41**, N 3.-P. 257-261.