

# Biocompatible photonic crystals expand applications from optics to medicine

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Credit: ITMO University

Researchers at ITMO University have developed a new approach for obtaining nontoxic magnetic photonic crystals, expanding their applications from photonics to biomedicine. Nanospheres made with the

new method may be used for designing drugs to fight thrombosis and cancer. The results of the research were published in *Scientific Reports*.

A magnetic photonic crystal (MPC) is basically a complex of nanoparticles that can selectively change its reflectance spectra under the influence of an applied [magnetic field](#). Such crystals can be used in photonics for making optical fibers, filters and other applications. However, there are problems concerning the conventional synthesis of MPCs. This procedure requires sophisticated equipment, high temperature and pressure and highly [toxic chemicals](#).

Scientists from ITMO University along with their colleagues from Saint Petersburg Electrotechnical University and N.N. Blokhin Russian Cancer Research Center have proposed a simple, inexpensive method that enables MPC production in mild conditions and without toxic chemicals. The method is based on the controlled destabilization process of a magnetic nanoparticle solution, resulting in formation of larger nanocrystals. The key feature of the process is that the reagents used for this purpose are known to be nontoxic and are approved by the Food and Drug Administration and the European Medical Agency for parenteral administration. The resulting nanocrystals have similar sizes, excellent stability and can form periodic structures under the influence of magnetic fields. Such features make it possible to regulate the wavelength of light reflected by nanocrystals, which may be useful for constructing sensory, communication and navigation systems.

Owing to their biocompatibility, such nanospheres can also be used in biomedicine for targeted [drug](#) delivery. "Unlike its alternatives, our method is suitable for diverse fields rather than just for optics and photonics. Due to mild synthesis conditions we are able to modify our technique in order to incorporate drugs in the structure of nanospheres," says Andrey Drozdov, researcher at the SCAMT Laboratory in ITMO University. "We are currently working on drugs for thrombosis and

breast cancer treatment. Since we avoid using toxic chemicals, such drugs are safe to inject into the body. As soon as they reach the required tissue we can apply magnetic field to separate MNS and release the medicine with precision."

Another advantage of the suggested [method](#) is flexibility. Controllable destabilization allows researchers to obtain nanospheres from various materials or their mixtures. "In this research we have used magnetite—iron oxide with strong response to magnetic [field](#). By adding other metal oxides, however, we could achieve hybrid nanospheres with features that were previously inconceivable," says Andrey Drozdov.

**More information:** Yulia I. Andreeva et al, The controllable destabilization route for synthesis of low cytotoxic magnetic nanospheres with photonic response, *Scientific Reports* (2017). [DOI: 10.1038/s41598-017-11673-4](#)

Provided by ITMO University

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