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NEWS

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Photonic crystals stretch to the UV

Deep-UV photonic crystals and total optical absorbers are some of the applications for multiwalled nanotube arrays.

Carbon nanotubes (CNTs), composed of a nanoscale network of carbon atoms, have been found to demonstrate remarkable electronic and mechanical properties. Now, researchers at the University of Ioannina in Greece and the University of Cambridge in the UK say that CNT arrays could be employed in photonic devices like deep-UV photonic crystals and total visible light absorbers

Researchers have already shown that nanotubes exhibit good photonic properties and make ideal saturable absorbers in ultrafast lasers, or nanoantennas for optical frequencies. The new work shows that regular arrays of CNTs could serve as photonic crystals too.

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Typically, a photonic crystal consists of a periodic arrangement of dielectric material, with a periodicity that is on the order a wavelength. Until now, most research in this field has focused on near infrared and optical frequencies.

Strong Bragg scattering

Elefterios Lidorikis and colleague Andrea Ferrari have now performed the first theoretical study of full photonic bandgaps in periodic arrays of aligned CNTs. In particular, the researchers studied the photonic response of 2D multiwalled nanotube square arrays under transverse magnetic polarized light – that is, when the CNTs are illuminated with polarized light along their lengths. The duo found strong Bragg scattering when the nanotubes in the array were spaced between about 20 and 30 nm apart and photonic band gaps appeared in the

deep-UV range of around 25 to 35 eV.

According to the duo, the finding means that all types of light manipulation in photonic crystals in the visible part of the electromagnetic spectrum (such as light localization, spontaneous emission inhibition, light guidance and manipulation, super-lensing and meta-materials exhibiting negative refraction) could potentially be applied to the deep-UV range too using MWNT arrays.

Exploiting light absorption

"At visible frequencies MWNTs absorb light and are thus no good for making photonic crystals," Ferrari told *nanotechweb.org*. "However, this high absorptivity can be exploited to design a new material, which instead of having a photonic band gap that reflects all light, exhibits a photonic absorption band that totally absorbs all incident optical light."

Such behaviour could also find use in solar collectors, he adds.

The work was published in *ACS Nano*.

About the author

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