CNT lasers come into view

I-Micronews

The team, led by Laurent Vivien at the University Paris-Sud, has demonstrated optical gain in semiconducting carbon nanotubes for the first time – a breakthrough that could lead to a revolution in photonics based on nano-objects like carbon nanotubes.

"*Our work means that we can now develop a new field based on carbon nanotube photonics,*" **Vivien** told nanotechweb.org. "*This will have a major impact on the nanotech and photonic communities.*"

Optical gain is the ability of a material to "amplify" light or to generate more photons than the number of photons it absorbs. It is the principle by which lasers work. The Paris-Sud team has now shown that semiconducting carbon nanotubes (CNTs) embedded in a thin polymer film show an optical gain at a wavelength of 1.3 µm at room temperature.

Semiconducting CNTs could be ideal for applications in nano-optoelectronics and photonics because they can emit and absorb light at distinct frequencies and sustain large electrical currents. Until now, however, no one had shown that CNTs can amplify light.

The researchers began by first extracting and selecting semiconducting CNTs from a mix of as-produced nanotubes that contain both semiconducting and metallic tubes. The resulting sample was free from impurities and metallic carbon. The CNTs were then embedded in a polymer and a light guiding thin film was fabricated in the structure.

Amplified light emission
Vivien's team then studied the nanotubes using well known optical techniques, including variable strip length and shifting excitation spot methods, and spectral narrowing. The sample was optically excited by an optical parametric oscillator laser emitting at a wavelength of 740 nm, pumped by a 2 ns-pulsed Nd:yttrium aluminium garnet (Nd:YAG) laser at 355 nm. The researchers collected the amplified spontaneous light emission of the CNTs from the edge of the sample and studied how this emission varied as a function of the length of tube strip excited.

The results from this study could allow researchers to make the first laser from CNTs and Vivien’s team plans to demonstrate one in its lab very soon. The second step, which will be just as challenging, will be to show electrical pumping in such a device – that is, to obtain lasing using only an applied voltage and no optical excitation. "*Finally, we would like to develop a new kind of photonics based on carbon nanotubes,*" revealed **Vivien**.

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