PHOTONIC CRYSTAL STRUCTURES TO CONTROL LIGHT ON A NANOSCALE

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INTRODUCTION.

Photonic crystals are nanostructures with "crystal" like periodicities. They can be used to control light through a diffraction process [1].

METHODOLOGY AND RESULTS.

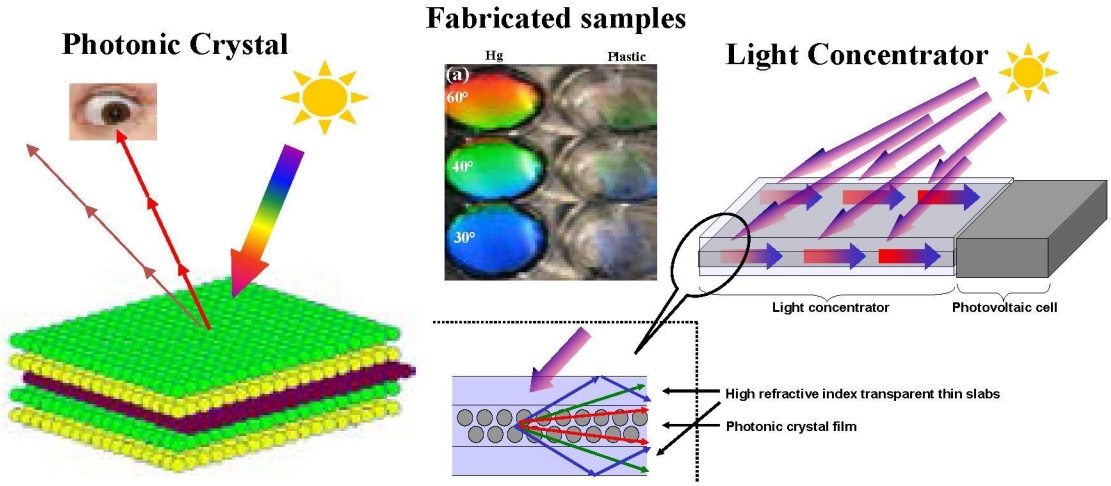
1) Calculations and numerical simulations: We developed new methods and software to calculate diffraction by photonic (colloidal) crystals.

2) Fabrication: We fabricated photonic crystal thin films by self-assembling nanoparticles into a *close-packed* crystal structure using two methods: Vertical Deposition and Capillary Deposition. We fabricated photonic crystals by self-assembling of *non-close-packed* colloidal crystals and from liquid like colloidal crystals we synthesize non-close-packed solid colloidal crystals. Also, we fabricated and analyzed monolayers of nano-spheres arranged in a 2D hexagonal lattice [2].

3) Characterization: We pioneered the use of angular resolved reflection spectroscopy to probe the structure and ordering of photonic crystals [3,4]. We solved a long standing problem of the origin of diffraction dispersion lines observed in the specular reflection direction by a multiple-diffraction mechanism. Also, we found how to achieve the best ordering quality of colloidal crystals through manipulating the electrostatic repulsion strength between colloidal particles.

CONCLUSIONS.

A new waveguiding effect in photonic crystals has been discovered. It will be useful for harvesting light for solar energy photovoltaic. We have found that incident light can be efficiently concentrated and redirected along the surface of thin film photonic crystals.



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