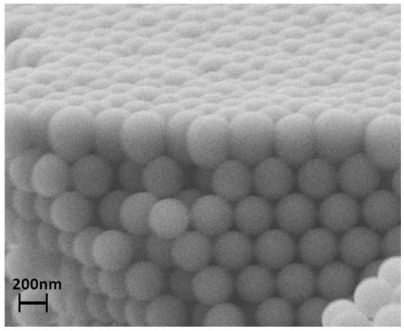
Labex MATISSE

Axe 4 “ondes”

"Manipulation of emission of nanocrystals embedded in opals"

Bourdillon Céline - INSP



SEM image of a cross section of an hetero-structure composed by a silica nanospheres opal and a silica sputtered defect layer

Hosting laboratories, teams and and thesis supervisors names:

Institut des NanoSciences de Paris (INSP), Nanostructures and Optics group, Catherine Schwob
Institut des NanoSciences de Paris (INSP), Chemical Physics for Functional Surfaces group

Research project

Opals are 3D photonic crystals composed of self-organized dielectric nanospheres. The resulting periodicity of the refractive index at the light wavelength scale induces a photonic band gap (which has the particularity to be incomplete). Opals present then a reflectance band whose maximum wavelength depends on the refractive index of the nanospheres, on their diameter and on the incidence angle of the light. When the periodicity of the opals is disturbed in the thickness direction, an authorized photonic band appears in the photonic band gap, leading to a decrease of the reflectivity into the reflectance band. These same optical properties can be observed with inverse opals which are air nanospheres organized in a dielectric matrix. The dielectric matrix can be composed of a polymer imprinted with a specific target molecule and then the opal can be used as an optical sensor of this molecule. Our purpose in to manipulate the fluorescence of nanocrystals, modified by the imprinted polymer inverse opal, to detect different molecules with one sensor.

Summerize your scientific results & impacts

We succeeded to integrate a sputtered silica layer, as a controlled planar defect, between two opals. This disruption of the opal periodicity led to a high and centered decrease of the reflectivity into the reflectance band. This kind of hetero-structure was used as a filter of nanocrystals’ emission and permitted an effective redirection of the fluorescence. The redirection gave spatial information directly linked to spectral information which will be used for molecular detection with the imprinted polymer inverse opals.

Main key facts (for instance publications / prices / oral presentations)

Publication: P.N.Hong et al, *Optical properties of an opal with a planar defect fabricated by inverse Schaefer and Langmuir-Blodgett techniques*, Opt. Quant. Electron. 46 (2014)

Presentations: Orals: CMD-JMC 2014, labex MATISSE annual day 2014,
DGA PhD students presentation day 2014.
Posters: DIAMON workshop, Ecole Polytechnique Doctoriales 2014, INSP PhD students presentation day 2014.