Optical characterization of a defect state in three-dimensional opal based photonic crystals

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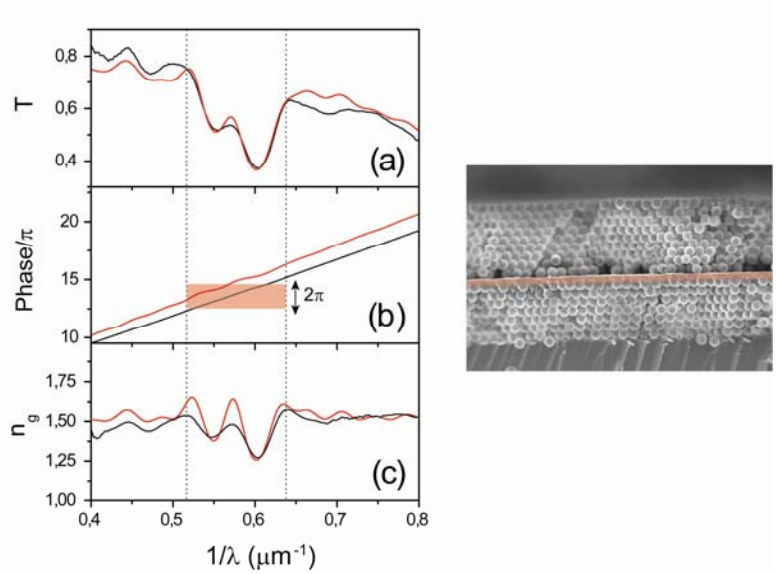
Nowadays it is widely acknowledged that the functionalities of opal based three-dimensional photonic crystals can be greatly enhanced by introducing defects in a controlled manner. A number of techniques have been developed to introduce such defects [1,2] and special interest has been placed on the introduction of planar ones.

In this work we present a complete optical characterization of polystyrene opal based photonic crystals containing planar defects in the form of a thin film of nanocrystalline TiO_2 [3]. Angle and polarization resolved reflectance and transmittance measurements are employed to study the angular dispersion of the forbidden interval and the localized state associated with the planar defect. Finally, an interferometric technique [4] is used to retrieve the phase in transmission through these samples. From the measured phase we have obtained the group velocity, and analyzed both quantities in order to obtain further evidence of the localization of light at the planar defect. Experimental results have been succesfully modelled with the Scalar Wave Approximation including extinction.



[1] P.V. Braun, *et al.*, *Advanced Materials*, **18**, 2665 (2006).
[2] A. Arsenault, *et al.*, *Advanced Materials*, **18**, 2779 (2006).
[3] R. Pozas, *et al.*, *Advanced Materials*, **18**, 2779 (2006).
[4] M. Galli, F. Marabelli, and G. Guizzetti, *Applied Optics*, **42**, 3910 (2003).