

## **Hetero-structuring effect on transmission properties in Triple film opal photonic crystals**

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For photonic crystals (PhCs) to have successful impact on advancement of optical circuits and realisation of various functionalities, the incorporation of artificial defects into 3D PhCs is necessary. Opal films represent a convenient approach to the realisation of 3D PhCs. Taking into account the limited flexibility of the self-assembly, the first steps can be studies of planar defects in opals and hetero-opals. Characterisation of hetero-PhCs should include the investigation of the dispersion of photonic bandgaps (PBG). While the dispersion of low-order PBGs in opal films is well known, the high order PBGs were hardly studied so far owing to high requirements to the crystallinity of PhCs. Correspondingly, the whole issue remains to be studied in hetero-opals. In particular, the questions of genuine interest for designing novel photonic materials are whether the total transmission of the heterostructure will be a linear superposition of partial transmission spectra of opal films or it will demonstrate some novel features originating from the collective superstructure effects, and whether the mode mismatch at interfaces or microcavity resonances will dominate the light transport and so on.

In this report, angle-resolved transmission of polarised light in triple-film hetero-opal has been investigated in the spectral range including several photonic bandgaps, and has been compared to transmission of constituent single-film opals. Modifications of the light propagation in the hetero-opal, such as the decrease of the polarization anisotropy and narrowing of the angular distribution of transmitted light have been observed and explained by the presence of interfaces. The flattening of PBG dispersion in the regions of overlapping bandgaps has been observed and linked to multiple reflections at the internal interfaces.