COLOUR REVEALS STACKING ORDER IN ULTRA THIN SELF-ASSEMBLED PHOTONIC CRYSTALS

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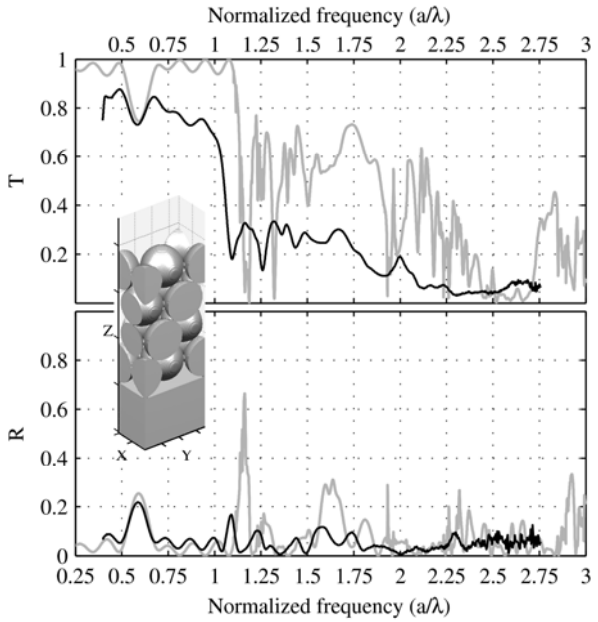
Abstract

In this work we present both experimental and numerical studies of the optical properties of artificial opals. The staking of up to four layers of spheres may arise according to three different arrangements: face-centered cubic, hexagonal close-packed or double hexagonal close-packed. Our study shows that the transmission spectra features are characteristic of the type of stacking and thus, each color region observed under the optical microscope can be unambiguously associated with one of the staking type. These features can be very faithfully modelled by the calculation even with no adjustable parameters. Inclusion of spectral dispersion and geometric detail allows nearly perfect fits the spectra. This result may have important repercussions for the control of the quality of the opals.



Transmission (top) and reflection (bottom) spectra of a four-layer opal arranged in a face centered cubic structure (i.e. with a stacking of the form ABCA). The black and gray curves represent experimental and simulated results respectively. In both case, the incident light is perpendicular to the stacking direction (i.e. the Z direction).

References

X. Checoury, S. Enoch, C. López, and A. Blanco, *Appl. Phys. Lett*. 90, 161131 (2007)