Amorphous dielectric materials with complete photonic band-gaps in 3D.

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Abstract

Over the past decade, it has been demonstrated that amorphous photonic dielectric materials can exist in two and three dimensions, displaying a complete photonic bandgap that inhibits the propagation of electromagnetic waves within a specific frequency range (1). These materials show great promise in both fundamental physics and various technological applications.

In a recent paper, our research group proposed a comprehensive framework that unifies the description of light transmission through three-dimensional amorphous dielectric materials. In our model we address the role of both light localization and the photonic bandgap (2). Here, we present experimental results on light transmission and reflection in amorphous dielectric networks, providing empirical support for the theoretical framework (2).

Our findings include compelling evidence of complete photonic bandgaps in dielectric networks made of silicon. To fabricate these network structures, we employed direct laser writing of polymer templates. The polymer structures were then converted into high refractive index silicon through chemical vapor deposition.

Of particular importance in our investigation is the specific examination of the role of direct coherence reflection or single scattering in the proximity of the photonic bandgap, necessary to interpret the experimental data.

References

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