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Measurement of photonic band diagram in non-crystalline photonic band gap (PBG) materials WEINING MAN, ERIC WILLIAMSON, SEYED HASHEMIZAD, POLIN YADAK, San Francisco State Univ., Dept. of Physics & Astronomy, MARIAN FLORESCU, Princeton University, Physics Dept.
— Non-crystalline PBG materials have received increasing attention recently and sizeable PBGs have been reported in quasi-crystalline structures or even in disordered structures. Band calculations for periodic structures produce accurate dispersion relations in them and refraction properties at their surfaces. However, band calculations for non-periodic structures employ large super-cells of N >100 building blocks, and provide little useful information other than the PBG frequency and width. Since band is folded into N bands, within the first Brillouin zone of the supper-cell. Using stereolithography, we construct various quasi-crystalline or disordered PBG materials and perform transmission measurements. The dispersion relations of EM wave (band diagrams) are reconstructed from the measured phase data. Our experiments not only verify the existence of sizeable PBGs in these structures, but also provide detailed information of the effective band diagrams, dispersion relation, group velocity vector, and their angular dependence. Slow light phenomena are also observed in these structures near gap frequencies. This study presents a powerful tool to investigate photonic properties of non-crystalline structures and provides important dispersion information, which is otherwise impossible to obtain.

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