# Assembled Crystals with Large Complete Photonic Band Gap and the Optical Devices Based on the Assembled Crystals

Technology #14393

## Applications

Assembled crystals created from the superposition of two sub-crystals or quasicrystals have applications in optical devices including polarizers, waveguides, and ring resonators.

## Problem Addressed

Previous photonic crystals have had photonic bandgaps (PBGs) with interdependent transverse magnetic (TM) and transverse electric (TE) PBGs. However, these assembled crystals are less interdependent, which makes them excellent candidates for novel optical devices because they can bend, split, couple, and filter TM/TE waves simultaneously on the scale of light wavelength. The novelty of this technology is the method for designing the assembled crystals that allows for a complete photonic bandgap and for using these crystals in optical devices.

## Technology

In this approach, the two necessary sub-crystals are a TM sub-crystal having a large TM PBG and a TE sub-crystal having a large TE PBG. The sub-crystals can be periodic or aperiodic. Since the dominant TM and TE PBGs of assembled crystals mainly arise from the different sub-crystals, they should be essentially independent of each other. Importantly, this offers the possibility to separately tune the TM and TE PBGs by altering the respective sub-crystals and make them overlap to generate a composite structure with a larger, complete PBG than previously known structures. These assembled crystals can be fabricated using a number of techniques including photolithography, nanoimprint lithography, electron beam lithography (EBL), and multiple exposure interference lithography (MEIL). Furthermore, it is straightforward to introduce purposeful defects in these crystals to generate optical devices. For example, two-photon direct laser writing can be used to introduce regions that can act as wave guides, filters, etc.

## Advantages

- A method to design assembled crystals with large, complete photonic bandgap
- Optical devices based on the assembled crystals

## Categories For This Invention:

Photonics
Data Communications
Telecommunications

255 Main Street, room NE 18-501
Cambridge, MA 02142-1601
Phone: 617-253-6966 Fax: 617-258-6790
http://tlo.mit.edu
Contact the Technology Manager: tlo-inquiries@mit.edu

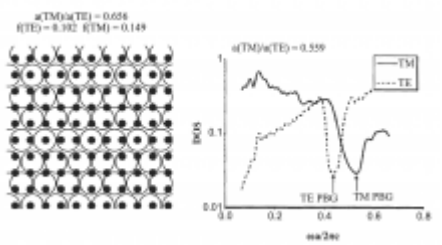
## Intellectual Property:

2-Pattern compound photonic crystals with a large, complete photonic band gap
Issued US Patent
8,923,661

## Inventors:

Edwin Thomas
Jin Lia

## Image Gallery:

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