Evaluation of Large-size 2D Photonic Crystal Slabs for Visible Light: as Precursor of 3D Photonic Crystals

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Visible-light-region three-dimensional (3D) photonic crystals (PhC) of large size, typically 1x1x1 mm^3, are targets in our study to fully clarify the novel optical properties and responses. We are fabricating at present two-dimensional (2D) PhC slabs of large size 5x5 mm^2 as precursor materials of the 3D-PhC. To fabricate the large 2D-PhC slabs and 3D-PhC, femtoseconds-laser fabrication and interferential-wave photolithography are utilized to avoid the restriction related to the electron-beam lithography. In the presentation, we will evaluate the large-size structure of submicron-meter period, e.g. 2D-PhC slabs made of photo-polymerized resin and metal-tip arrayed 2D-PhC slabs, by atomic force microscopy. In addition, we will report the basic optical characteristics in detail. Furthermore, the electromagnetic response of the samples will be analyzed by numerical methods: scattering-matrix and finite-difference time domain techniques. The road to large-size 3D-PhC will be also discussed on the basis of the fabrication of the precursor materials.