

課題番号 : F-13-HK-0040
利用形態 : 共同研究
利用課題名 (日本語) :
Program Title (English) : Fabrication of metallic photonic crystals by direct laser writing and atomic layer deposition
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1. 概要 (Summary)

We report the experimental realization of three-dimensional (3-D) metallic photonic crystals by combining femtosecond direct laser writing (DLW) and atomic layer deposition (ALD) techniques. Wide photonic bandgaps were observed in optical reflection spectra at near infrared wavelengths.

2. 実験 (Experimental)

We first fabricated 3-D woodpile photonic crystal templates by DLW in photoresist SZ2080.^[1,2] Then we deposited Al₂O₃ (10 nm thick, it is used for both strengthening the adhesion between the polymer and metal) and Iridium (Ir, 40 nm thick) were deposited onto the templates by an ALD system (SUNALE-R, Picosun) to form the metallic photonic crystals. The topography of photonic crystals were examined using a field-emission scanning electron microscopy (SEM) (JSM-6700FT, JEOL), and the optical properties were characterized by a Fourier transform infrared (FTIR) spectrometer (FT/IR-6000TM-M, JASCO) equipped with infrared microscopy. The formation of Ir was confirmed by XRD (RINT-2000, RIGAKU) measurements.

3. 結果と考察 (Results and Discussion)

The SEM image (Fig. 1(a)) of a typical Ir woodpile photonic crystal shows excellent structural quality and good periodicity. A wide photonic band with the band edge at ~1.5 μm was observed as seen from the reflection spectrum shown in Fig. 1(b). For comparison, the spectrum of an Ir flat film and the calculated spectrum of the Ir-coated photonic crystal using a finite-difference time-domain (FDTD) simulation method were also included in the figure. It is found that the experimental

measured wide photonic band can be reproduced very well by the FDTD simulation. The fabricated 3D metallic photonic crystals may have many potential applications such as sensing, imaging, energy harvesting, and controlling over thermal emission.^[3,4]

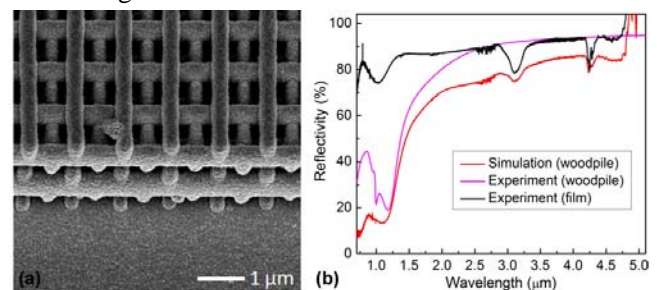


Fig. 1 SEM image (a) and reflection spectra (b) of an Ir-coated woodpile photonic crystal.

4. その他・特記事項 (Others)

・参考文献

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5. 論文・学会発表 (Publication/Presentation)

なし。

6. 関連特許 (Patent)

なし。