

*課題番号 : F-12-HK-0012
 *支援課題名 (日本語) : フェムト秒レーザー直接描画及び原子層堆積法による3次元金属フォトニック結晶の作製
 *Program Title (in English) : Fabrication of 3D metallic photonic crystals by femtosecond direct laser writing and atomic layer deposition
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※概要 (Summary) :

We report the fabrication of three-dimensional (3D) metallic photonic crystals based on polymer templates combining femtosecond direct laser writing and atomic layer deposition (ALD) techniques. Wide photonic stop gaps were observed in optical reflection spectra of the metallic structures at near infrared wavelengths. The fabricated 3D metallic photonic crystals may have many potential applications such as thermal emitters for energy applications.

※実験 (Experimental) :

A chirped-pulsed amplifier (CPA) Ti:sapphire laser (Hurricane, Spectra-Physics, λ : 800nm, τ : ~150fs, 1 kHz) was used for direct laser writing of photonic crystal templates in SZ2080 resists. Al_2O_3 (10 nm thick) and Ir (50 nm thick) films were deposited onto the templates by a ALD system (SUNALE-R, Picosun). The topography of fabricated photonic crystals were examined using a field-emission scanning electron microscope (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.

※結果と考察 (Results and Discussion) :

We successfully fabricated metallic (Ir) square spiral photonic crystals with periodicity of 1 μm . They exhibit wide photonic band in near infrared region. The following figure shows the SEM image and reflection spectrum as a typical example. The SEM image (top view) exhibits good structural

quality and the measured photonic band can be reproduced well by FDTD simulations.

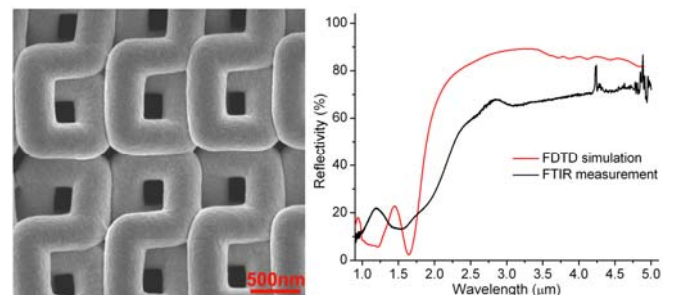


Fig.1.

Fig.2

Fig.1. Metallic square spiral photonic crystal

Fig.2. Reflection spectra

※その他・特記事項 (Others) :

With the fabrication techniques demonstrated here, we expect to fabricate more complicated 3D metallic photonic crystals and will try to explore their applications.

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論文・学会発表 (Publication/Presentation) :なし

関連特許 (Patent) :なし