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Fabrication of Plasmonic Spectral Filter for Visible Light Communication

○Tatsuya Nakashio[1], Megumi Shiraishi[1], Yasushi Oshikane[1], Motohiro Nakano[1],
Claire Heck[2], Shoichi Mochizuki[2], Kensuke Murai[2]

[1]Osaka Univ., [2]AIST Kansai

E-mail: k.murai@aist.go.jp

1. Introduction

Visible light communication by white LED lights would be useful for communication and environmental sensing. A plasmonic spectral filter [1] based on a metal-insulator-metal (MIM) structure can be used for this purpose. (see Fig.1) Considering that absorption dips are numerically predicted for this MIM structures even with normal incidence and that change in the absorption dip is expected if either the refractive index or the thickness of the insulator layer changes, this structure could be used as a photonic device for environmental sensing as well as for visible light communication.

2. Fabrication of the MIM Structure

In order to fabricate a plasmonic spectral filter, we have developed several prototypes of the MIM structure on glass substrates by conventional vacuum deposition method and established the importance of monitoring the thickness of the insulator layer for the MI structure [2, 3]. However, the PLZT, which exhibits electro-optic effect as an insulator, requires a perovskite crystalline phase, which is achieved under the annealing temperature of 700°C in air. Under this temperature, the first silver layer (M1) aggregates on the glass substrate, and the MIM structure needs to be protected with capping and seeding layers, as shown in Fig. 2. In order to fabricate the designed filtering wavelength, we employed in situ monitoring of the absorption dip for the MI structure.

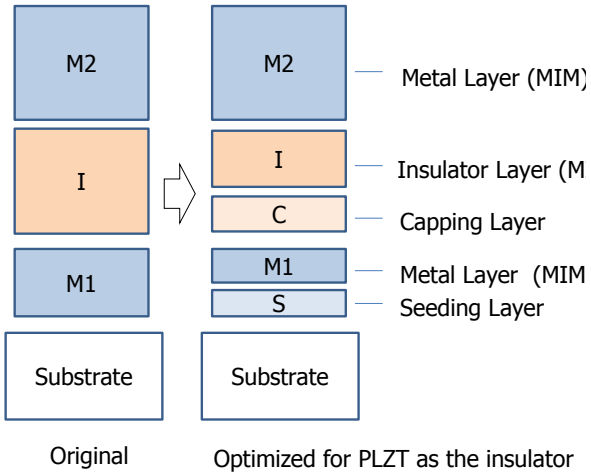

Fig.2. Schematics of the original and optimized MIM structures for PLZT as the insulator layer.

3. Conclusions

We have successfully monitored the absorption dip during the coating of the insulator layer and have demonstrated the relationship between the filtering wavelength for the MIM structure and the dip wavelength for the MI structure.

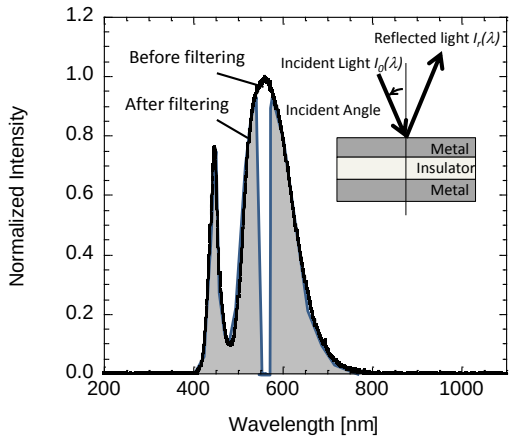

Fig.1. Schematic of filtering property for white LED light by a plasmonic spectral filter with a MIM structure.

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