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Fabrication of Plasmonic Spectral Filter for Ubiquitous Photonics (2)

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Fast active switches are required for the next-generation visible light communication by white LED lights in the ubiquitous network society. One candidate for the switching device is the plasmonic spectral filter [1] based on the meta-insulator-metal (MIM) structure using plasmonic materials such as silver and gold. (see Fig.1) Absorption dips are numerically predicted for the MIM structures even in the normal incidence. Since change in the absorption dip is expected if the refractive index or the thickness of the insulator layer changes, it would be useful as photonic devices for environmental sensing as well as for visible light communication. In order to realize the plasmonic spectral filter, we have reported fabrication of several prototypical samples of the MIM structure on glass substrates by conventional vacuum deposition method. [2] However, the thickness of the insulator layer must be controlled below the nanometer level. Figure 2 shows the calculated spectral reflectance for the metal-insulator (MI) structure with various thicknesses of the insulator layer at the incident angle of 60 degree into the metal surface inside the glass substrate. As shown in Fig. 2, linear change of the absorption dips for the MI structures was expected as a function of thickness of the insulator layer. The wavelengths of the measured absorption dips agree with the numerical predictions. This result indicates that the spectral monitoring for the MI structure is useful for the thickness monitoring of the deposition of the insulator layer.

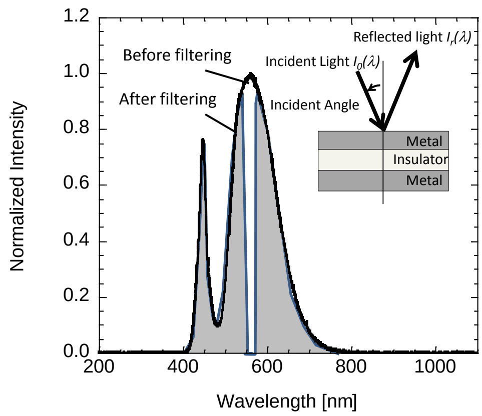

Fig. 1. Schematic of filtering property for white LED light by the plasmonic spectral filter with the MIM structure.

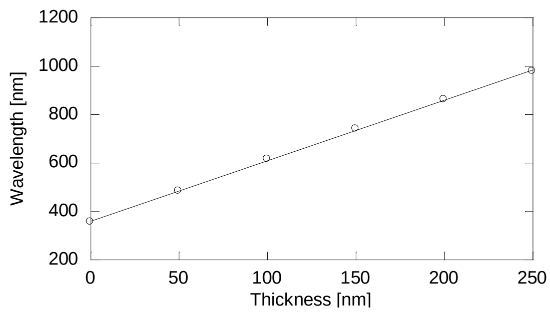

Fig.2. Calculated absorption dips for the MI structure at the incident angle of 60 degree inside the glass (BK7) substrate for the P-polarized light with the thickness of the insulator (MgF_2) layer.

[1] K. Murai et al., The 59th JSAP Spring Meeting (Waseda Univ., March 17, 2012) 17p-F4-15.

[2] K. Murai et al., JSAP-OSA Joint Symposia 2012 (The 73th JSAP Autumn Meeting) (Ehime Univ., Sept. 11, 2012) 11a-G1-1.