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 利用形態 : 機器利用  
 利用課題名(日本語) : THz 導波路における伝搬損失のコーティング金属膜厚依存性  
 Program Title (English) : Film thickness dependence on propagation loss of coated metal in terahertz waveguides  
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## 1. 概要(Summary)

Metal-coated dielectric terahertz (THz) devices, which are fabricated by 3D printing and metal film coating, have been recently attracted because of their easy fabrication method for integrated structures. However, there is a lack of reports about the required film thickness of coating metal for THz wave propagation. Therefore, this study focused on evaluating the required film thickness on metal-coated/dielectric waveguides.

## 2. 実験(Experimental)

### 【利用した主な装置】

LL 式高密度汎用スパッタリング装置, 高速シリコン深掘りエッチング装置

### 【実験方法】

First, we tried to fabricate rectangular waveguides using a deep reactive etching process. Yet, it was challenging to make a conformal film on such a structure. Hence, parallel-plate waveguides (PPWG) were applied by the dicing saw instead. As shown in Figure 1(a), the silicon substrate was diced into smaller plates with a size of  $14 \times 2.5$  or  $14 \times 5$  mm<sup>2</sup> by dicing saw. The diced plates were coated with metal film by sputtering with designated film thickness. Afterward, ten plates were stacked with 280 μm-interval and formed 2.5 or 5 mm-long PPWG. The transmittance of PPWGs was evaluated by THz time-domain spectroscopy.

## 3. 結果と考察(Results and Discussion)

By applying dicing saw and sputtering, metal-coated Si substrates with well-controlled size

and the film thickness can be obtained (inset photograph of Figure 1(a)). Figures 1(b1) and 1(b2) show the transmittance spectra of 2.5 and 5 mm-long PPWG with different Au film thickness. The required film thickness of Au is about 70 and 105 nm for the propagation length of 2.5 and 5 mm, respectively.

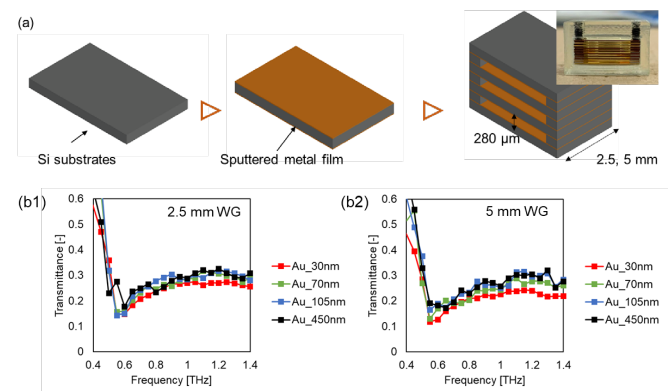


Figure 1. (a) Fabrication method of stacked metal-coated silicon PPWG. Transmittance spectra of (b1) 2.5 mm- and (b2) 5 mm-long Au-coated PPWG with different Au film thickness.

## 4. その他・特記事項(Others)

なし。

## 5. 論文・学会発表(Publication/Presentation)

1. Y. Huang et al., 81th JSAP autumn meeting, 11A-Z24-2, Sep. 2020.
2. Y. Huang et al., IRMMW-THz 2020, Nov. 2020.
3. Y. Huang et al., 65th JSAP spring meeting, 18P-Z09-12, Mar. 2021.

## 6. 関連特許(Patent)

なし。