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利用課題名(日本語) : 金属/誘電体テラヘルツ導波管の作製に向けた金属材料選択
Program Title (English) : Material evaluation of metal film for metal/dielectric THz waveguides
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1. 概要(Summary)

The metal coated dielectric waveguides have been concentrated in terahertz (THz) frequency region. Metal gives an important role to prevent penetration of THz wave out of the waveguides. however, metal material dependence on propagation properties in THz region has not been clarified. Therefore, we evaluated propagation properties of THz waveguides coated with various metal films.

2. 実験(Experimental)

【利用した主な装置】

ブレードダイサー

【実験方法】

Blade dicer was used for dicing 2-inch Si substrates into $2.5 \times 14 \text{ mm}^2$ chips. Diced substrates were sputtered by metallic film, then stacked as parallel plate waveguides, as shown in Fig. 1.

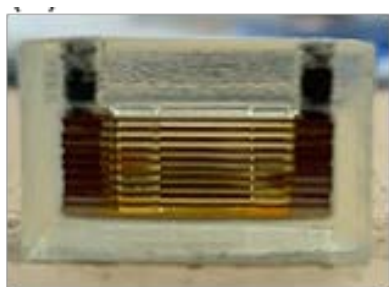


Fig. 1 Appearance of stacked chips.

3. 結果と考察(Results and Discussion)

First, Au coated waveguide with 2.5 mm-length was fabricated and the simulation of bulk Au with the same structure was conducted. As shown in Fig. 2, experimental result agreed well with the

simulation, which indicates the applicability of the experimental design.

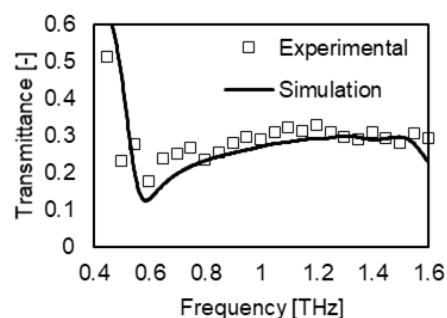


Fig. 2 Experimental and calculated transmittance of THz wave in Au waveguides.

To evaluate material evenly, various metal films were deposited with sufficient thickness, i.e., 5 times of their respective skin depths in 1 THz, which were extrapolated by the general formula in microwave engineering. Si substrate without coating showed almost no transmittance. In contrast, metal coating resulted in higher transmittance, which indicates that metal films guided the propagation of THz waves. Au and Cu showed the highest transmittance, and that of Cr and Ti were lower than the previous two.

4. その他・特記事項(Others)

共同研究者: 東京大学大学院理学系研究科 小西 邦昭

5. 論文・学会発表(Publication/Presentation)

1) Y.Y. Huang *et al.*, The 67th JSAP spring meeting, 13p-B508-5, March 2020.

6. 関連特許(Patent) なし.