

課題番号 : F-20-NU-0031  
 利用形態 : 機器利用  
 利用課題名(日本語) :  
 Program Title (English) : Unidirectional thermal conductivity enhancement in yttrium iron garnet due to the effect of spin waves  
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### 1. 概要(Summary)

This research focuses the light on the directed thermal conductivity enhancement due to the interaction between spin waves and phonons in magnetic lattices, as illustrated in Fig. 1. For that, a measurement technique is developed based on the 3-omega method to prove and quantitatively measuring this enhancement. Accordingly, the heater/sensors configuration of the 3-omega method need to be deposited on the surface of the magnetic lattice material by photolithography and sputtering techniques.

### 2. 実験(Experimental)

#### 【利用した主な装置】

両面露光用マスクアライナ(Suss Micro Tec AG 製 MA-6), スパッタリング装置一式(キャノンアネルバ製 E-200S), レーザー描画装置(Heidelberg Instruments 社製 DWL66FS)

#### 【実験方法】

The laser mask writer Heidelberg DWL66FS is used to write the Cr mask of the heater/sensors configuration. The mask aligner MA-6 is then used for the photolithography process. After that, the sputtering device E-200S is used to deposit a Cr layer 5 nm as an adhesive layer and 150 nm of Au to construct the configuration of heater/sensors.

### 3. 結果と考察(Results and Discussion)

Fig. 2 shows the heater/ sensors configuration of the proposed method patterned on the surface of

yttrium iron garnet (YIG) by photolithography. HMDS was used to enhance the adhesion of the photo resist on YIG. The sample then deployed to the sputtering device. Stabilizing Au on YIG was challenging even with the adhesive Cr layer. However, by manipulating the sputtering parameters ( $P_{Ar}=1$  Pa and RF power 200 W), a stabilize Au configuration was obtained.

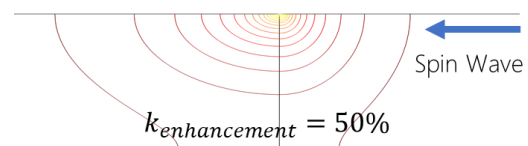


Fig. 1 The effect of the spin wave on the heat diffusion (thermal conductivity) in magnetic lattices

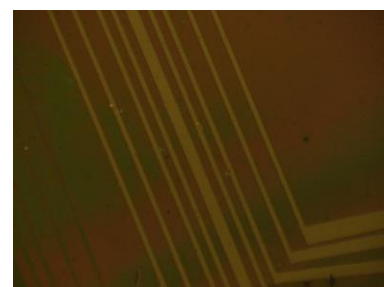


Fig. 2 The heater/sensor configuration of the proposed measurement method.

### 4. その他・特記事項(Others)

none

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

none

### 6. 関連特許(Patent)

none