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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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キーワード/Keyword : Spin-caloritronics, thermal conductivity measurement, yttrium iron garnet, 3 ω method, リソグラフィ・露光・描画装置

1. 概要(Summary)

The objective of this research is to investigate the interaction between spin waves and phonons in Yttrium Iron Garnet (YIG) which is reflected as an enhancement in the thermal conductivity in the direction of the spin waves. For that, a measurement technique is developed based on the well-known 3 omega (3ω) method for the purpose of observing quantitatively this enhancement.

The proposed measurement technique is based on a set of symmetric micro heater/sensors which are fabricated mainly by using photolithography and sputtering.

2. 実験(Experimental)

【利用した主な装置】

レーザー描画装置 (Heidelberg Instruments DWL66FS), 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), スパッタ絶縁膜作製装置 (MES アフティ社製 AFTEX-3420)

【実験方法】

First a thin layer of SiO₂ is sputtered by AFTEX-3420 to insulate the noise of the spin waves on the signal of the sensors. The laser writer (DWL66FS) is used then to write the pattern of the heater/sensors either on a Cr mask or directly on the photoresist layer on the surface of the sample. On the other hand, the mask aligner (Suss Micro Tec AG MA-6) is utilized to transfer the pattern

from the mask to the photoresist layer.

E-200S sputtering device is utilized finally to deposit a 5 nm layer of Cr as an adhesive layer and 250 nm of Au as the main structure of the heater/sensors.

3. 結果と考察(Results and Discussion)

As a first stage of the research, SiO₂ insulation layer deposition were tested successfully on YIG which indicates that adhesion enhancement is not required. Moreover, sputtering Cr/Au multi thin films on YIG by E-200S was also calibrated for acquiring the desired thickness of the heater/sensors pattern.

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