傾斜組成 $Ni_{1-x}Mg_xO$ における THz 反強磁性共鳴制御

Control of THz antiferromagnetic resonance in composition-graded $Ni_{1-x}Mg_xO$

京都大学化学研究所 [1], 岐阜大学 [2], 物質・材料研究機構（NIMS）[3]

○上野 智貴 [1], 大野 悠太 [2], 林 兼輔 [3], 山田 啓介 [2], 嶋 睦宏 [2], 大矢 豊 [2],

小野 輝男 [1], 森山 貴広 [1]

Kyoto Univ. [1], Gifu Univ. [2], National Institute for Materials Science[3],

°Tomoki Ueno[1], Yuta Ohno[2], Kensuke Hayashi[3], Keisuke Yamada[2], Mutsuhiro Shima[2], Yutaka Ohya[2],

Teruo Ono[1], and Takahiro Moriyama[1]

E-mail: ueno.tomoki.65m@kyoto-u.ac.jp

THz waves refer to electromagnetic waves in the frequency range of 0.3 to 10 THz, and are expected to be applied in various fields, such as imaging and sensing technologies. Especially in the field of communication technology, THz science and technology are intensively investigated in order to realize ultrafast data processing. While ferromagnetic materials, which have been used in microwave components, have their magnetic resonance frequency in the GHz band, that of antiferromagnetic materials can be up to 1 THz. Therefore, antiferromagnetic materials are promising materials for the post-5G technology. In previous study, we have succeeded in controlling the antiferromagnetic resonance property (e.g. resonance frequency and Q factor) by cation doping [1]. In this research, in order to seek more controllability on the resonance properties, we investigate the antiferromagnetic resonance of composition-graded $Ni_{1-x}Mg_xO$.

Pellet samples of composition-graded $Ni_{1-x}Mg_xO$, employed in the experiments, were made by layering the different composition $Ni_{1-x}Mg_xO$. The composition of each layer was controlled by adjusting the amount of the NiO and MgO powders to the target ratio. The layered sample was uniaxially die-pressed to form a 5-mm-diameter and 3-mm-thick pellet. The pellet was then sintered in air at 1500℃ for 2 hours. THz wave transmission was measured by using a frequency domain continuous wave (CW)-THz spectroscopy system capable of scanning up to ω = 2 THz with the frequency resolution <10 MHz. Figure shows transmission spectra for the composition-graded $Ni_{1-x}Mg_xO$ as a function of frequency, the peak width of the antiferromagnetic resonance is broadened as the composition grading is more gradual. The result indicates that the composition grading is effective in controlling the peak width, or Q-factor.

[1] T. Moriyama *et al.*, Phys. Rev. Mat. **4**, 074402(2020).

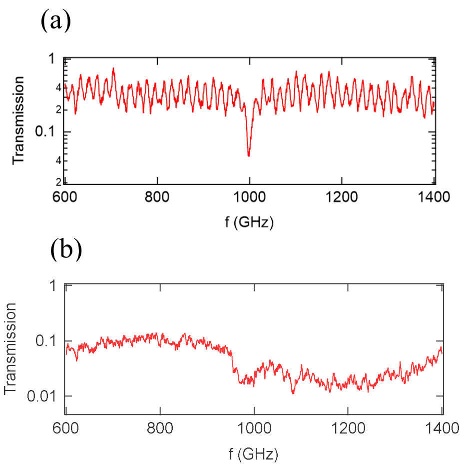

Figure: Frequency dependence of the THz wave transmission for $Ni_{1-x}Mg_xO$ samples of (a) 2-ply (x = 0 and 0.20) and (b) 5-ply (x = 0, 0.05, 0.10, 0.15, and 0.20) at 300 K.