λ-Ti3O5@TiO2 : Electromagnetic wave absorber in the sub-terahertz region with switching functionality

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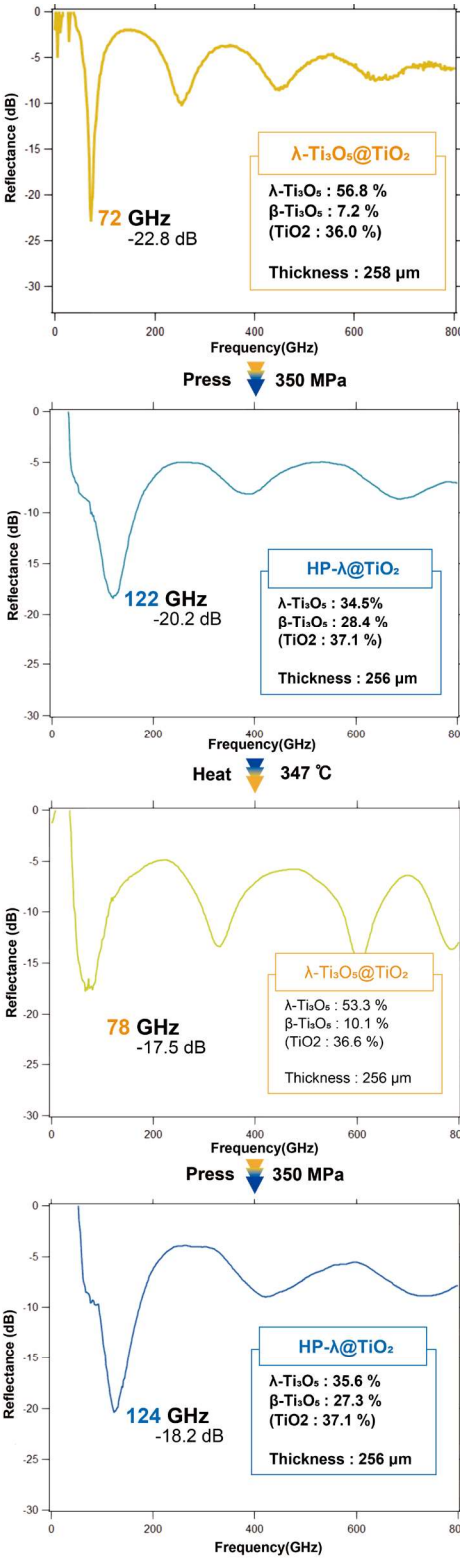
With the realization of 5G network systems, research in the sub-terahertz wave region has begun to achieve higher speed data transmission [1].Despite the development of a technology in sub-terahertz wave region, there are relatively few reports of materials utilizing in this region.

Here, I report λ-Ti_3O_5@TiO_2 working as a switchable wave-absorbing material in the sub-terahertz wave region.This material is a mixture of λ-Ti_3O_5 with conductor-semiconductor phase transition properties[2] and TiO_2 with insulator properties. The sub-terahertz wave absorption properties were investigated by using terahertz time-domain spectroscopy (THz-TDS). λ-Ti_3O_5@TiO_2 absorbs more than 90 % of sub-terahertz wave. Among them, the 59 μm thickness sample shows absorption peat at 566 GHz with -22.5 dB. Furthermore, it has the property of significantly changing resonance frequency in response pressure and heat. This sample was absorbed -23.3 dB (94 %) at around 80 GHz, but when the pressure of 350 MPa was applied , absorbed -20dB (90 %) around 122 GHz. After heated the sample with the pressure of 350 MPa, it was absorbed -17.5 dB (87 %) at around 80 GHz. Reproducibility was also confirmed from experiments in which pressure of 350 MPa was applied again. These results are involved with the pressure-heat phase transition of λ-Ti_3O_5.

Electromagnetic wave-absorbing materials are essential for selective use of electromagnetic waves in sub-terahertz wave region. In this work, I observed λ-Ti_3O_5@TiO_2 have great potential as wave absorber in sub-terahertz wave region. λ-Ti_3O_5 is environmentally friendly, economical, and commercially useful. λ-Ti_3O_5 will open up opportunities for applications in the field of sub-terahertz wave region.



[1]Sebastian, M. T., *et al.* Int. Mater. Rev., 60, 392–412 (2015). [2] Ohkoshi, S., *et al.* Nat. Chem., 2, 539–545 (2010). [3]Tokoro, H., *et al,* Nat. Commun. 6, (2015)