Fabrication of Electrically Conductive Zones on Polymers Using Laser Irradiation

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Integration into flexible polymer materials is a necessary factor for developing flexible and miniaturized electronics. To achieve integration, technologies that allow the creation of electrically conductive zones on the surface of dielectrics must be developed.
Laser-induced graphene (LIG) is a three-dimensional form of graphene[1] made by focusing a laser beam onto a carbon-containing material such as graphite, polymers, or even paper[2]. The laser beam vaporises the material, leaving a porous network of electrically conductive graphene sheets.
This study applies the LIG formation method to two polymers: polyimide (PI) and polyetherimide (PEI). After measuring surface resistance for different laser modification parameters and wavelengths, it was found that the PEI sample on which LIG was formed using 10.6 μm irradiation of a CO_2 laser had the lowest sheet resistance, reaching ~7.5 Ω/□.
After choosing the optimal laser micromachining parameters, with which the minimum surface LIG resistance was obtained, a 13 GHz antenna was formed on the PEI surface. The antenna had a positive gain of 3.5 dB at 12.5 GHz.

References

[1] J. Lin, Z. Peng, Y. Liu et al. Nature Communications, 5 (2014) 5714
[2] R. Ye, D. K. James, J. M. Tour, Accounts of Chemical Research, 51 (2018) 1609

Figures

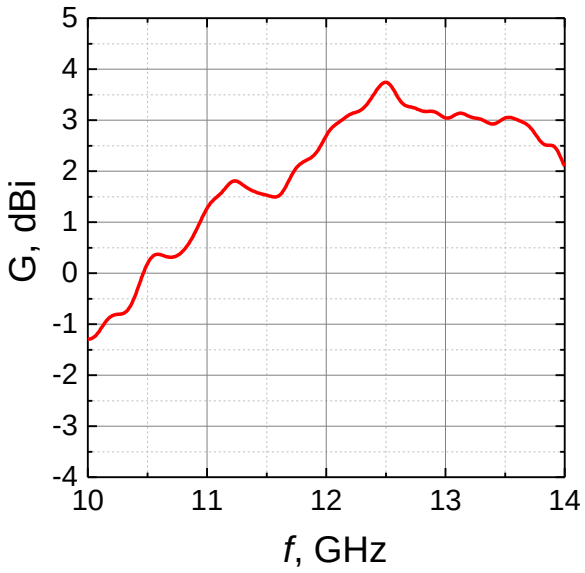

Figure 1: Gain of LIG 13 GHz antenna formed on PEI using 10.6 μm laser irradiation.