High Frequency Optoelectronic Mixing using an hBN/Graphene/hBN-based Device

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Abstract

The electronic mixing operation is a necessary step for communication systems as it allows to recover the information signal which is generally transmitted over the communication medium at a very high frequency.
When transmitting data over optical fibers, the received signal is first transformed into an electrical signal using a photodetector before the mixing operation with a local oscillator signal is performed.
Graphene, with its attractive properties such as light absorption, high carrier mobility and compatibility with the existing silicon technology can be used to perform both operations with a single device. In this work an hBN\graphene\hBN-based optoelectronic mixer is demonstrated. The graphene is embedded to a device in a coplanar wave guide structure [1] (Figure 1). The optical signal is incident on the graphene channel, an RF signal is injected to the input of the device and the output signal is measured. The obtained conversion efficiency is around -50dB (Figure 2). This result helps to push forward the investigation of optoelectronic mixing using graphene.

Figures

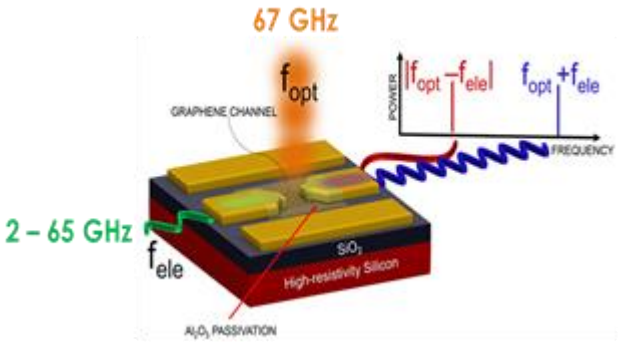

Figure 1: Optoelectronic mixing of an intensity modulated optical signal at 67GHz and an RF signal in [2GHz-65GHz] frequency band

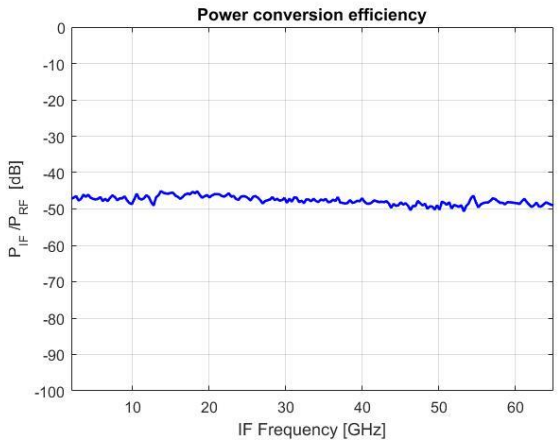

Figure 2: The power conversion efficiency of the mixing operation at the intermediate frequency (IF) band

References

[1] Montanaro et Al., Nano lett.,16 (2016) page (2988-2993)