Millimetre-wave, Graphene-based power detector

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Abstract
In this paper we present a graphene based power detector for mm-Wave applications. The fabricated power detector is based on the diode which is formed due to the asymmetric metal-graphene-metal contacts with different work functions [1]-[2]. The chosen metals are Ni and Ti whose work functions are 5.04eV and 4.33eV, respectively. Due to the unique properties of graphene as a zero band gap material with very high electron mobility and saturation velocity, graphene is a very good candidate for very high frequency applications. The proposed layout in Figure 1.(a) reduces the losses represented in the series resistance of the junction formed which improves the quality factor of the diode and the frequency response as well. The measured DC characteristics shown in Figure 1.(b) shows the diode characteristics of the proposed design with a clear asymmetry between forward and reverse biases. The in an in-house MMIC process fabricated graphene diode shown in Figure 2.(a) is measured as a millimeter-wave power detector. The power detection responsivity is measured according to the schematic shown in Figure 2.(b). Figure 2.(c) shows the measured responsivity up to our measurement capabilities limits of 67 GHz. The shown data are raw data, i.e. without de-embedding of the input matching circuit. The demonstrated DC-characteristics and RF power detection promote the diode to be used in mm-wave applications as a low loss, high quality factor power detector.

References
[1] Amirhasan Nourbakhsh, et. al., Appl. Phys. Lett., **97** (2010) 163101.
[2] Mircea Dragoman, et. al., Appl. Phys. Lett., **112** (2012) 084302

Figures

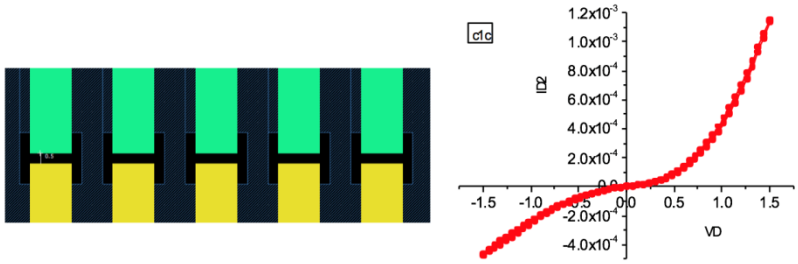

Figure 1 (a) Layout of the fabricated Graphene-based RF power detector using Ni and Ti as contact metals with different work functions, (b) measured DC charaterestic of the diode

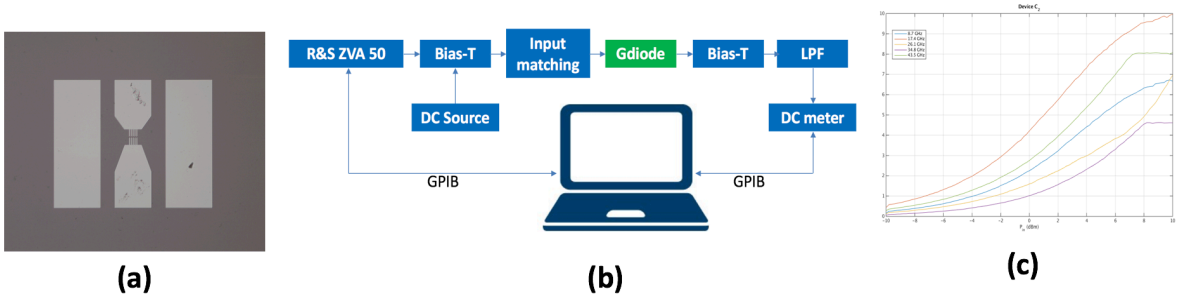

Figure 2 (a) Die micrograph of the fabricated power detector, (b) Power detection measurement setup, (c) Measured responsivity