Near-Field Mid-Infrared Photocurrent in Graphene

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Abstract

Light detectors that operate in the mid-infrared spectrum are of potential interest for detection of molecular resonances and thermal imaging. The conventional photodetectors in this range however require significant cooling or exhibit low sensitivity. Due to the broadband absorption of light in graphene, it is a promising material for sensitive mid-infrared photodetectors at room temperature. [1] In order to understand the large scale device physics of such detectors it is important to also understand how photocurrent is generated at defects, such as wrinkles or grain boundaries and what influence they have on the large scale photodetector behavior.

Our study investigates light-driven electrical photocurrents in graphene for the mid-infrared range of incident light. Using a scattering-type scanning near-field optical microscope [2] we manage to couple the light very locally into the graphene and therefore reach an extremely high resolution of the photocurrent. As the light absorption in this case causes mainly a local heating effect, the current can be understood in terms of thermoelectric effects. [3] We investigate the influence of local defects, such as grain boundaries [4] and bilayer spots in CVD graphene as well as charge puddles in exfoliated graphene [5] on photocurrent. We determine how carrier density influences these effects and show that the results can be nicely explained using a thermoelectric model. We show an unprecedented high resolution of the photocurrent and demonstrate that this technique can be used for the local characterization of graphene devices.

References

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