Terahertz mapping of large-scale graphene with reflection and transmission mode

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Abstract
With the rapid developments of large-scale graphene growth and transfer method, the quality inspection during fabrication process is highly demanded. Characterization of spatially electrical parameters of a given sample is critical because the inhomogeneity may dramatically reduce the performance of final devices[1]. Terahertz time-domain spectroscopy (THz-TDS) is a non-contact, fast and convenient method to characterize electrical properties of large-scale graphene and two-dimensional materials[1,2]. THz-TDS with transmission mode has been widely investigated to characterize graphene, however, the specific requirement for substrates which need to be transparent for THz wave limits its application in non-transparent substrates, such as highly-doped silicon[3]. Therefore, reflection-mode THZ-TDS technique is a good alternative. Here we will show the electrical characterization of large scale graphene (around 6 cm×7 cm) on 4-inch silicon wafer with reflective THz-TDS technique. DC conductivity would be extracted from complex conductivity based on the fitting of Drude-Smith model. We compared the experimental results obtained from reflection mode with those from transmission mode respectively and the similar results displayed its validity. This work provides a reference value for wider application of THz-TDS in quality inspection during graphene production scenarios.

References

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Figures

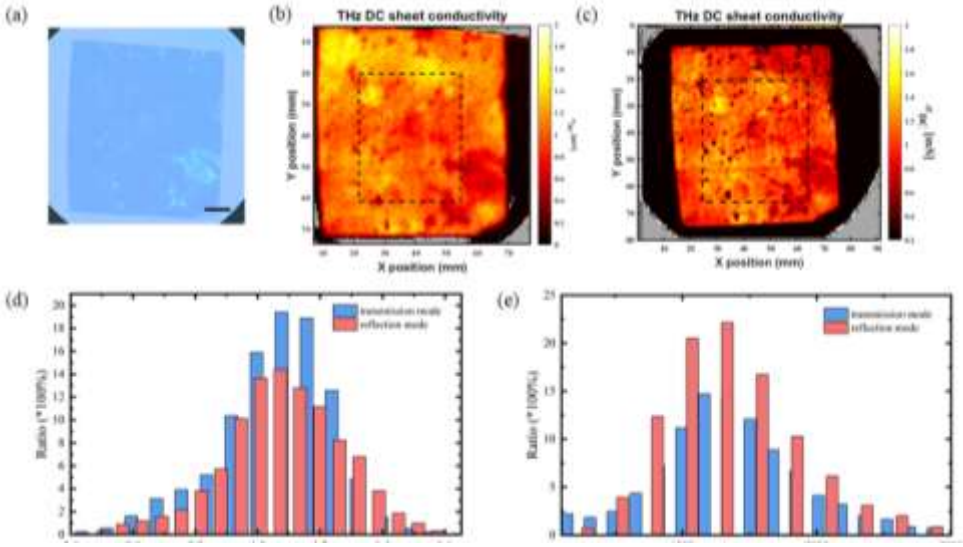

Figure 1: (a) Optical microscopy of the sample, the inset scale bar is 1 cm; (b) and (c) THz mapping of sheet DC conductivity measured by reflective and transmissive THz-TDS system; (d) and (e) Comparisons of DC conductivity and mobility obtained from reflective and transmissive THz-TDS system, respectively.