グラフェン-GaN ヘテロ接合のショットキーダイオードと光起電力特性

Schottky diode and photovoltaic properties of graphene-GaN heterojunction

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Introduction: Recently, heterojunction of graphene with conventional bulk semiconductors has attracted significant attention for fabrication of high performance devices. Gallium nitride (GaN) is one of the most promising wide band gap semiconductor for application in light-emitting diodes (LEDs), photodetectors, high-electron-mobility transistors etc. In this prospects, integration of graphene with GaN can be significant for device fabrication with novel properties and applications [1]. Here, we demonstrate fabrication of graphene-GaN heterostructure and its diode and photovoltaic properties.

Experimental: In this studies, Si-doped GaN film deposited on sapphire substrate was obtained from NGK insulators, Japan. Chemical vapor deposited graphene film was transferred on the GaN/sapphire sample for device fabrication (fig. 1a). Au and Al electrodes were deposited by thermal evaporation technique using ULVAC VPC-260F. Current density-voltage (J-V) characteristics measurements were carried out at different temperatures using a two probe system and Keithley 2401 SourceMeter.

Results and discussion: J-V characteristics of the graphene/GaN heterojunction device were investigated under dark and light illumination with change in temperature (fig. 1b and 1c). Under dark condition, increase in forward bias current as well as saturation current was observed, and decrease in device ideality factor was obtained with increase in temperature. Under illumination of light, decrease in the open circuit voltage (V_{oc}), while increase in short circuit current density (J_{sc}) was obtained with increase in temperature. The observed temperature dependent device characteristics of the graphene/n-GaN heterojunction can be significant to understand the junction behavior and photovoltaic action.

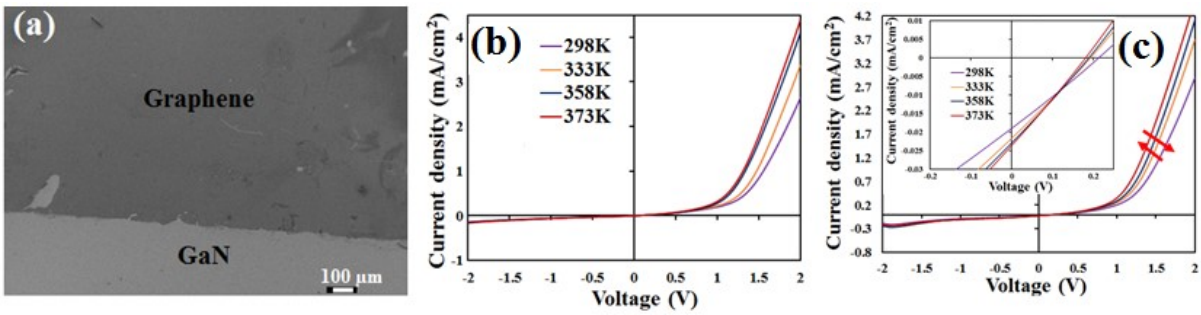

Figure 1 (a) Scanning electron microscope (SEM) image of graphene-GaN heterostructure (b) J-V characteristics of graphene-GaN junction under (b) dark and (c) illumination conditions.

Reference: 1) Kalita, Tanemura et al. Applied Physics Letters, in press (2017)