

Transfer Printed AlGa_N/Ga_N Membrane Photo-HEMT

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Introduction

After revolutionizing the power and radio-frequency transistor technologies, the AlGa_N/Ga_N based high electron mobility transistor (HEMT) is spreading its boundary over other emerging application fields. In accordance with that trend, AlGa_N/Ga_N based photo-HEMT holds a great promise towards the development of high performance solar blind UV imaging system. However, the previous research updates on AlGa_N/Ga_N photo-HEMT were limited to device on rigid and bulk substrates[1]. Meanwhile, the advent of releasable AlGa_N/Ga_N 2DEG membrane has added new features like flexibility, three-dimensional integration etc to the HEMT technology[2]. In this article we have realized AlGa_N/Ga_N membrane photo-HEMT and transferred it to polyethylene terephthalate substrate via transfer printing method.

Methods

We started the fabrication process of AlGa_N/Ga_N membrane photo-HEMT with the AlGa_N/Ga_N on insulator (GaNOI) epi-wafer. The procedure to manufacture GaNOI epi-wafer can be found elsewhere[3]. The schematic of the fabrication process is represented in Fig. 1(a). The effective illuminated active area of photo-HEMT is 100 μm². Transparency of gate electrode at 360 nm wavelength was 60%. The image of actual device is shown in Fig. 1(b) (inset).

Results

Fig. 1(b) displays the transfer characteristics (VGS-ID) of the photo-HEMT, depicting two orders increase in off-state drain current (ID) under 360 nm of UV illumination with reference to dark condition. The derived responsivity, photo to dark current and detectivity are 9.08×10^2 A/W, 1.49×10^2 and 1.10×10^{13} Jones, respectively.

Conclusion

Our fabricated AlGa_N/Ga_N membrane photo-HEMT can be considered as the primary step towards the realization of flexible photo-HEMTs.