Photocurrent Gain Photodetector based on 2D materials/High density Nanodot Array Hybrid Structure

JiYeong KIM
Jiyeong Kim, Jihoon Jeon, Gwangtaek Oh, Sohwi Kim, Seoyul Lim, Jungeun Oh, and Bae Ho Park
KonKuk Universtiy, 120 Neungdong-ro, Gwangjin-gu, Seoul, Repulbic of Korea
jjunguz208@konkuk.ac.kr

Abstract

Recently, various types of nanostructures have been applied to photodetectors to achieve strong light absorption and high photocurrent efficiency. Accordingly, photodetectors based on two-dimensional materials (2D) such as Graphene or MoS_2 exhibit broadband response and high carrier mobility, but suffer from low absorption coefficient, which limits the photocurrent efficiency. In this study, we improved the performance of photodetectors by forming 2D-0D hybrid structures with nanodot arrays, while maintaining the advantages of 2D materials. The perfectly aligned $Pb(Zr_{0.20}Ti_{0.80})O_3$ nanodot arrays based on Anodic Aluminum Oxide (AAO) templates concentrate the incident light more effectively, resulting in photocurrent values several orders of magnitude higher than those of conventional 2D materials. Under 532nm illumination, they exhibited short rise/decay times and high external quantum efficiency. Such photodetectors may have important prospects in optoelectronics applications such as biological imaging and sensing.

References

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Figures

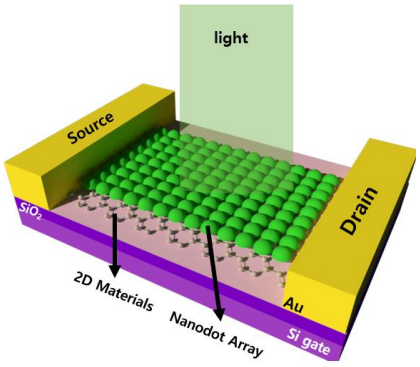

Figure 1: Schematic of the 2D-0D hybrid photodetector.