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Wafer-scale arrayed p-n junctions based on few-layer epitaxial GaTe XIANG YUAN, LEI TANG, State Key Laboratory of Surface Physics and Department of Physics, Fudan University, Shanghai 200433, China, WEIDA HU, National Laboratory for Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai 200083, China, FAXIAN XIU, State Key Laboratory of Surface Physics and Department of Physics, Fudan University, Shanghai 200433, China — Two dimensional (2D) materials have showed appealing applications in electronics and optoelectronics. Gapless graphene presents ultra-broadband and fast photoresponse while the 2D semiconducting MoS2 and GaTe exhibit highly sensitive and tunable responsivity to the visible light. However, the device yield and its repeatability call for a further improvement of 2D materials to render large-scale uniformity. Here we report a layer-by-layer growth of the wafer-scale GaTe by molecular beam epitaxy. To develop the arrayed p-n junctions, the few-layer GaTe was grew on three-inch Si wafers. The resultant diodes reveal good rectifying characteristics and photoresponse with maximum photodetection responsivity of 2.74 A/W and photovoltaic external quantum efficiency up to 62%. The photocurrent reaches saturation very fast within 22 μs and shows no sign of device degradation after 1.37 million cycles of operation. Most strikingly, such high performance has been achieved across the entire wafer, making the volume production of devices accessible. Finally, several photo-images was acquired by using these photodiodes with a reasonable contrast and resolution, demonstrating for the first time the potential for these 2D technology coming into the real life.

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