High-Performance Flexible Photodetector Arrays Based on All-inorganic Perovskite Quantum Dots

K. Shen[*], H. Xu[*], X. Li[*], M. Wang[#], K-L. Choy[#], H. Liu[*], and J. Wu[*†]

[*] Department of Electronic and Electrical Engineering, University College London, Torrington Place, London WC1E 7JE, UK (hao.xu.15@ucl.ac.uk)
[#] Institute for Materials Discovery, University College London, Torrington Place, London WC1E 7JE, UK (k.choy@ucl.ac.uk)
[†] Institute of Fundamental and Frontier Science, University of Electronic Science and Technology of China, Chengdu 610054, China (jiangwu@uestc.edu.cn)

Abstract

With rapid development of flexible electronics (FE), the demands for portable, wearable and arrayed devices are ever increasing. Promising for large-scale integrated FE, perovskites have recently attracted numerous attentions due to their excellent optoelectronic properties, low cost and compatibility with flexible substrates.[1] Here, 32 × 24 vertical-stacked flexible and high-performance photodetector arrays are demonstrated, based on the optimized all-inorganic perovskite nanocrystals, as shown in Figure 1. The blending of CsBr/KBr precursor is used to reduce surface states as well as facilitate charge transport, which resulted in the improved optical properties and film formation. By precisely controlling the ratio of CsBr/KBr mixture, the perovskite-based flexible photodetector arrays exhibit excellent photoresponse features, especially at zero biased voltage, including high photoresponsivity of 141 mA/W, remarkable specific detectivity of 1.25×10^{12} Jones and large on/off ratio of 8.1×10^4. Moreover, such photodetector arrays sustain the electrical stability under large banding angles up to 170° and reproducible flexibility after hundreds of bending cycles, indicating a great potential for optical communication, digital display and artificial electronic skin applications.

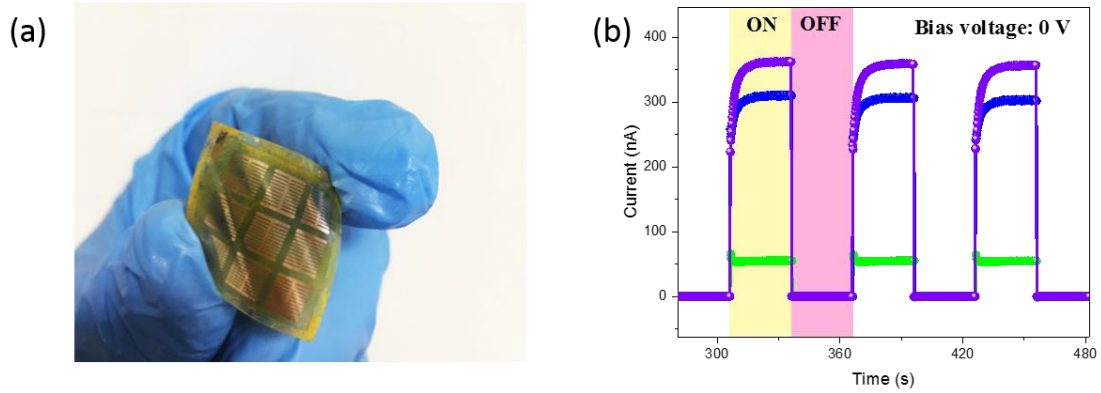

Figure 1: (a) Optical image and (b) the transient photoresponse curves of as-fabricated flexible photodetector arrays under 405 nm, 450 nm and 520 nm illumination at zero bias.

Reference

[1] Shen, K.; Li, X.; Xu, H.; Liu H.; Wu, J.: Enhanced Performance of ZnO Nanoparticle Decorated All-Inorganic $CsPbBr_3$ Quantum Dot Photodetectors. Journal of Materials Chemistry A, Vol. 7, pp. 6134-6142, 2019.