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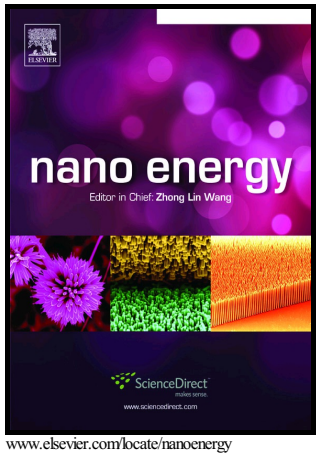

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Abstract

Piezotronics have shown great promises in promoting the efficiency of photoelectrochemical (PEC) reactions, while their full-gear functionalities are constrained by the longstanding contradiction between the charge collection of semiconductors and the screening effect of polarization materials. In this report, we tackle this issue by decoupling the collecting and screening trajectories using graphene as the charge collector. The moderate charge density of graphene ensures minimal screen of the adjacent electrical polarizations and concurrently delivers photogenerated free carriers toward the counter electrode. Based on a PMN-PT/graphene/TiO_2 piezotronic PEC system, substantial performance gains were received through tuning the interfacial electronic energy level via ferroelectric polarizations. Forward poling could lead to a 50% improvement of photocurrent density at 1 V vs. RHE and a favorably shifted onset potential. Both calculation and experimental results suggest this outcome was