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Graphene-CdSe quantum dot hybrid as a platform for the control of carrier temperature

In a graphene and quantum dots (QDs) hybrid structure, the graphene is known to play the role of an electrode that conducts the photoexcited carriers from the QDs to the electrodes. Thus, the yield of photocurrent of the QD ensemble is greatly enhanced [1]. However, in our study, the graphene provides a platform to control the energy relaxation of optically excited carriers from QDs. Thus, the temperature of photocarriers of QDs is controllable. Due to the moderate carrier temperature, the observed photocurrent from the hybrid structure reveals a photothermoelectric effect, which becomes even stronger when the Fermi energy, E_F, is located near the charge neutrality point (CNP) of the graphene. However, the photothermoelectric behavior weakens with increased E_F. Such a behavior originates from the varying electron-phonon coupling strength that is dependent upon E_F of the graphene [2].

References

[1] S.H. Cheng, T.M. Weng, M.L. Lu, W.C. Tan, J.Y. Chen, Y.F. Chen, Nat. Sci. Rep.3 (2013) 2694.
[2] M.K. Ghimire, H.Z. Gul, H. Yi, D.X. Dang, W. Sakong, N.V. Luan, H.J. Ji, S. C. Lim, FlatChem 6 (2017) 77-82.

Figures

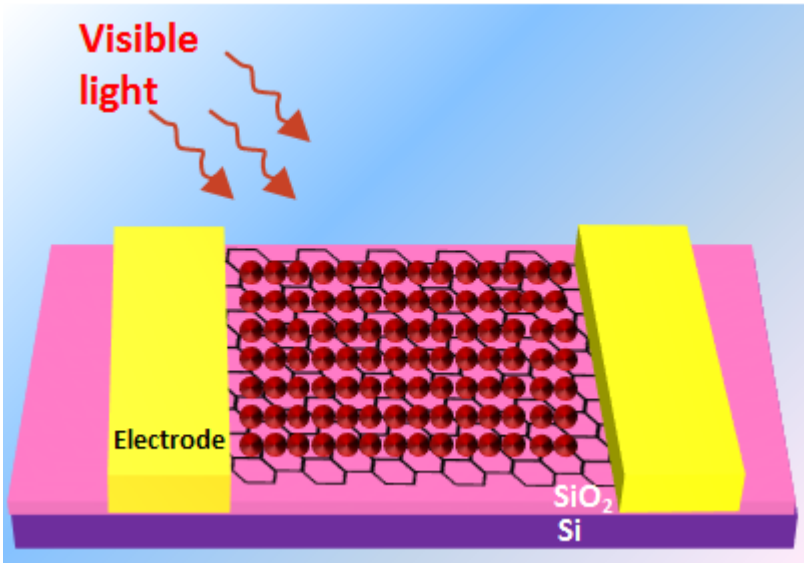

Figure 1: Schematic diagram showing light shining on graphene-CdSe QD hybrid FET