Tuning the Bandgap of Exfoliated InSe Nanosheets by Quantum Confinement

Conference Paper · August 2014

DOI: 10.13140/2.1.2656.1926

CITATIONS
10

READS
118

12 authors, including:

Simon A Svatek
Universidad Politécnica de Madrid
29 PUBLICATIONS **774** CITATIONS

SEE PROFILE

Amalia Patanè
University of Nottingham
311 PUBLICATIONS **4,738** CITATIONS

SEE PROFILE

Oleg Makarovsky
University of Nottingham
88 PUBLICATIONS **2,859** CITATIONS

SEE PROFILE

15:00-15:15
Oral: Nilanthy Balakrishnan
Tuning the Bandgap of Exfoliated InSe Nanosheets by Quantum Confinement

The isolation of single-atomic layer graphene has led to a surge of interest in other layered crystals with weak, van der Waals-like, interlayer coupling [1]. A variety of two-dimensional (2D) crystals have been investigated. However, some of these crystals are unstable under ambient conditions, and those that are stable offer only limited functionalities, such as band gaps that cannot be tuned.
Here we report the successful exfoliation of thin layers of gamma-InSe, a III-chalcogenide van der Waals crystal [2]. We show that the near-band edge photoluminescence peak and absorption-induced photoconductivity undergo a strong blue-shift to higher photon energies with decreasing the thickness of the flake, consistent with 2D quantum confinement of photo-excited carriers by atomically flat interfaces. The InSe nanoflakes are optically and electrically stable, they emit at room temperature, the thickness of the flake can be used to tune the absorption and emission in the technologically mid-infrared spectral range between 1 and 0.8 microns, and the flake morphology is compatible with 2D electrodes. These are all desirable features in the exploitation of 2D InSe in planar 2D device architectures for electronic and photonic applications.

[1] K. S. Novoselov et al., PNAS 2005, 102, 10451.
[2] G. W. Mudd et al., Adv. Mater. 2013, 25, 5714.

Co-authors: G.W. Mudd, S. A. Svatek, T. Ren, A. Patanè, O. Makarovsky, L. Eaves, P. H. Beton, Z. D. Kovalyuk, G. V. Lashkarev, Z. R. Kudrynskyi and A. I. Dmitriev