

## Accepted Manuscript

### Article

Few-layer Tellurium: one-dimensional-like layered elementary semiconductor with striking physical properties

Jingsi Qiao, Yuhao Pan, Feng Yang, Cong Wang, Yang Chai, Wei Ji

PII: S2095-9273(18)30010-0  
DOI: <https://doi.org/10.1016/j.scib.2018.01.010>  
Reference: SCIB 315

To appear in: *Science Bulletin*

Received Date: 16 November 2017  
Revised Date: 23 December 2017  
Accepted Date: 23 December 2017

Please cite this article as: J. Qiao, Y. Pan, F. Yang, C. Wang, Y. Chai, W. Ji, Few-layer Tellurium: one-dimensional-like layered elementary semiconductor with striking physical properties, *Science Bulletin* (2018), doi: <https://doi.org/10.1016/j.scib.2018.01.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Few-layer Tellurium: one-dimensional-like layered elementary semiconductor with striking physical properties

Jingsi Qiao<sup>1,2§</sup>, Yuhao Pan<sup>1§</sup>, Feng Yang<sup>1§</sup>, Cong Wang<sup>1</sup>, Yang Chai<sup>2</sup> and Wei Ji<sup>1,\*</sup>

<sup>1</sup>*Beijing Key Laboratory of Optoelectronic Functional Materials & Micro-Nano Devices, Department of Physics, Renmin University of China, Beijing 100872, China*

<sup>2</sup>*Department of Applied Physics, The Hong Kong Polytechnic University, Hong Kong, China*

\* [wji@ruc.edu.cn](mailto:wji@ruc.edu.cn)

§ contributed equally to this work

Received: 2017/11/16

Revised: 2017/12/23

Accepted: 2017/12/23

### Abstract

Few-layer Tellurium, an elementary semiconductor, succeeds most of striking physical properties that black phosphorus (BP) offers and could be feasibly synthesized by simple solution-based methods. It is comprised of non-covalently bound parallel Te chains, among which covalent-like feature appears. This feature is, we believe, another demonstration of the previously found covalent-like quasi-bonding (CLQB) where wavefunction hybridization does occur. The strength of this inter-chain CLQB is comparable with that of intra-chain covalent bonding, leading to closed stability of several Te allotropes. It also introduces a tunable bandgap varying from nearly direct 0.31 eV (bulk) to indirect 1.17 eV (2L) and four (two) complex, highly anisotropic and layer-dependent hole (electron) pockets in the first Brillouin zone. It also exhibits an extraordinarily high hole mobility ( $\sim 10^5$  cm<sup>2</sup>/Vs) and strong optical absorption along the non-covalently bound direction, nearly isotropic and layer-dependent optical properties, large ideal strength over 20%, better environmental stability than BP and unusual crossover of force constants for interlayer shear and breathing modes. All these results manifest that the few-layer Te is an extraordinary-high-mobility, high optical absorption, intrinsic-anisotropy, low-cost-fabrication, tunable bandgap, better environmental

Download English Version:

<https://daneshyari.com/en/article/8917352>

Download Persian Version:

<https://daneshyari.com/article/8917352>

[Daneshyari.com](https://daneshyari.com)