Adaptive Photocurrent Generation in ReS_2-2D Te Heterostructure

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Semiconducting layered materials (SLMs) have attracted much attention due to their versatile potential applications in photodetectors, phototransistors, and light-emitting diodes [1,2]. The devices based on these materials can be far more adaptable when they are hybridized in heterostructures [3,4]. Here, we report a heterostructure based on n-type rhenium disulfide (ReS_2) and p-type tellurene (2D Te). The light response of the heterostructure device was elucidated by the magnitude, phase (flow direction), and position of the light-induced current. Diverse photocurrent generation mechanisms were discovered at the interface of ReS_2-2D Te hybrid structure, including the photovoltaic effect (PV), photothermoelectric effect (PTE), and the hybrid of PV and PTE, rather than the expected PV only, which has been unprecedented for LSMs-based phototransistors so far. Furthermore, adaptive photocurrent can be achieved by controlling back-gate bias. These results are expected to contribute to the fundamental understanding of photocurrent generation in the heterojunction and develop new concepts of optical sensors with a designed detection mechanism.

References

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Figure

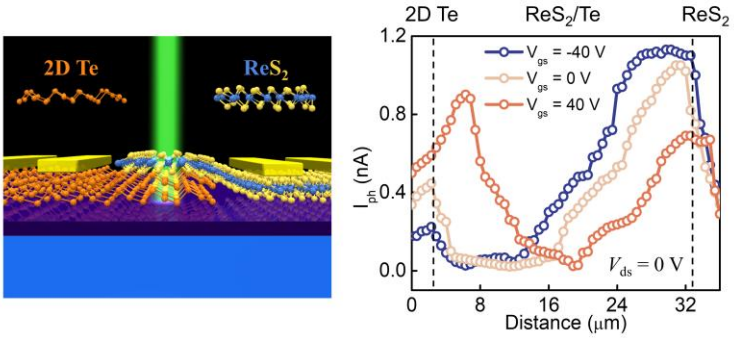

Figure 1: Adaptive photocurrent generation in ReS_2-2D Te Heterostructure at different back-gate biases.