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Tunable ambipolar polarization-sensitive photodetectors based on high anisotropy $ReSe_2$ ENZE ZHANG, Fudan University, PENG WANG, Shanghai Institute of Technical Physics, ZHE LI, CE HUANG, KAITAI ZHANG, SHIHENG LU, WEIYI WANG, SHANSHAN LIU, Fudan University, HEHAI FANG, XIAOHAO ZHOU, WEIDA HU, Shanghai Institute of Technical Physics, PENG ZHOU, FAXIAN XIU, Fudan University — Atomically-thin 2D layered transition metal dichalcogenides (TMDs) have been extensively studied recently because of their intriguing physical properties and promising applications in nanoelectronic devices. Among them, $ReSe_2$ is a material that exhibits a stable distorted 1T phase and strong in-plane anisotropy. Here, the anisotropic nature of $ReSe_2$ is revealed by Raman scattering under linearly polarized excitations. Utilizing high-quality $ReSe_2$ nanosheets, we are able to build top-gate $ReSe_2$ field-effect transistors which show an excellent on/off current ratio exceeding 10^7 and a well-developed current saturation at room temperature. Importantly, the successful synthesis of $ReSe_2$ directly onto hexagonal boron nitride substrates has effectively improved the electron motility over 100 times and the hole mobility over 50 times at low temperatures. Remarkably, the $ReSe_2$ based photodetectors show a polarization-sensitive photo-responsivity due to the intrinsic linear dichroism originated from high in-plane optical anisotropy. With a back gate the linear dichroism photodetection can be unambiguously tuned both in the electron and hole regime. The appealing physical properties of $ReSe_2$ demonstrated in this study identify it as an emerging candidate for electronic and optoelectronic applications.

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