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Electronic and optoelectronic device applications based on ReS₂

ERFU LIU, MINGSHENG LONG, YAOJIA WANG, YIMING PAN, Nanjing Univ, CHINGHWA HO, National Taiwan University of Science and Technology, BAIGENG WANG, FENG MIAO, Nanjing Univ — Rhenium disulfide (ReS₂) is a unique semiconducting TMD with distorted 1T structure and weak interlayer coupling. We have previously investigated its in-plane anisotropic property and electronic applications on FET and digital inverters [1]. In this talk, we will present high responsivity phototransistors based on few-layer ReS₂. Depending on the back gate voltage, source drain bias and incident optical light intensity, the maximum attainable photoresponsivity can reach as high as 88,600 A W⁻¹, which is one of the highest value among individual two-dimensional materials with similar device structures. Such high photoresponsivity is attributed to the increased light absorption as well as the gain enhancement due to the existence of trap states in the few-layer ReS₂ flakes. The existence of trap states is proved by temperature dependent transport measurements. It further enables the detection of weak signals [2]. Our studies underscore ReS₂ as a promising material for future electronic and sensitive optoelectronic applications. References:[1] Erfu Liu, et al. Nature communications 6, 6991(2015). [2] Erfu Liu, et al. Advanced Functional Materials 26, 1938 (2016)

Erfu Liu
Nanjing Univ

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