Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplementary Information

Enhanced performance of photodetector based on graphene/CVD-grown dendritic ReS_2/Ta_2O_5 vertical heterojunction

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The following provides information on the wet transfer method of graphene and ReS2 used in the photodetector's heterostructure.

1. Graphene wet transfer method

The first step involved a thin layer of PMMA, spin-coat onto graphene on one side of the Cu foil. This layer also acts as a protective barrier for the next steps. The PMMA/graphene/Cu sample was baked at 150 °C for 90 s. Because graphene grows on both sides of the Cu foil, the graphene on the rear unprotected face was then removed by oxygen plasma. The next step is Cu substrate etching, for which various chemicals were mentioned in the literature.

2. ReS_2 wet transfer method

CVD-grown ReS2 released from 300nm SiO2/Si by the etching-free transfer method was then transferred onto the substrates. The ReS2 film was first spin-coated with a PMMA thin layer at 2000 rpm for 20 s and was baked at 180 °C for 15 min. And ReS2 film was transferred with Di water using sonication. ReS2/PMMA was transferred onto the sample at room temperature. The next step is PMMA cleaning with acetone.

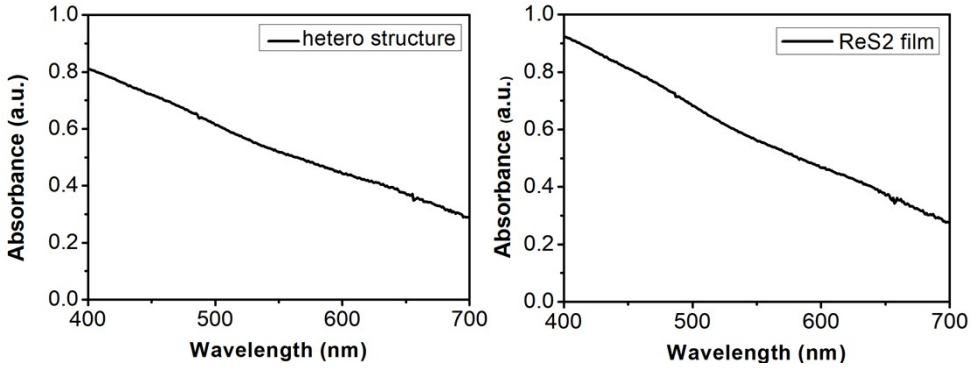

Fig. S1† The light absorption spectra of ReS_2 film and graphene/ReS_2/Ta_2O_5 heterostructures

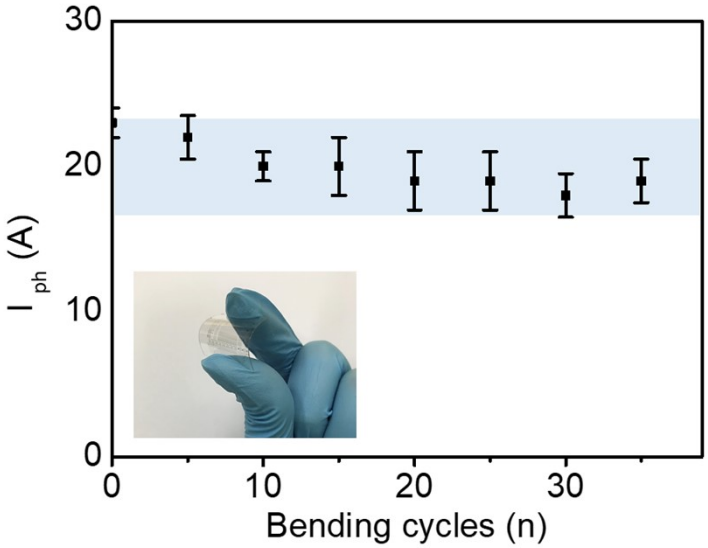

Fig. S2† The stability of the flexible device after the bending cycle

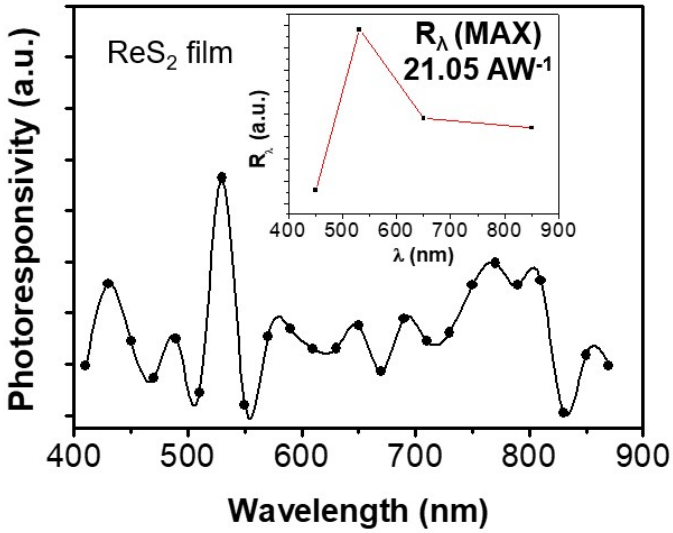

Fig. S3† R_λ values of the ReS_2 film-based photodetector in the wavelength range of 410 – 870 nm with an interval of 20 nm

Table 1. Photodetection performance compared with the other ReS_2 films.

Structure	Method	$V_D(V_G)$	Photo current	R_λ [A/W]	T_{rise} [s]	T_{decay} [s]	Source	Reference
Hybrid film on glass	**CVD**	**0.1 V (-)**	**35 uA**	**11.43**	**0.06**	**0.1**	**532 nm**	**This work**
Hybrid flakes on SiO_2	Exfoliation	1 V (30V)	20 uA	7×10^5	0.03	0.03	550 nm	[1]
Graphene flake on SiO_2	Exfoliation	0.1 V (30 V)	8 nA	8.61	-	-	532 nm	[2]
Graphene and CQD on SiO_2	CVD	0.3 V (-)	-	0.4	-	-	635 nm	[3]
MoS_2 and Graphene on SiO_2	CVD	5 V (-)	8.34 uA	0.4	0.02	0.03	532 nm	[4]
Bilayer ReS_2 film on sapphire	CVD	0.5 V (-)	2 uA	4×10^{-3}	5.5	11.7	500 nm	[5]
ReS_2 film on mica	CVD	1 V (-)	5 nA	0.98	17.8	14.3	490	[6]
Bilayer ReS_2 film on mica	CVD	10 V (-)	2 nA	0.217	0.61	1.59	325	[7]

Reference

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