Supporting Information

One-Dimensional CdS_xSe_{1-x} Nanoribbons for High-Performance Rigid and Flexible Photodetectors

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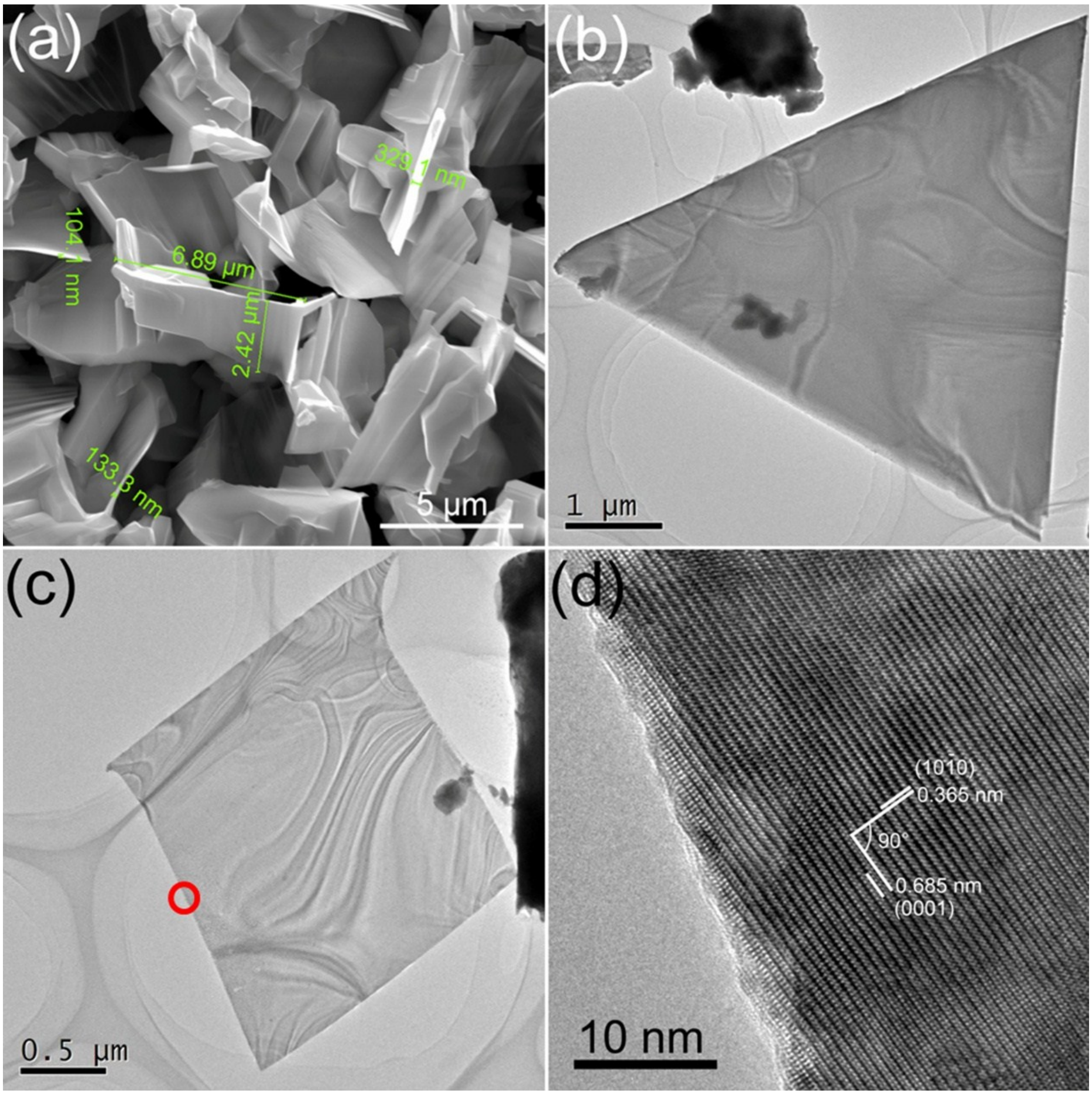

Fig. S1 Morphology and structural characterizations of the as-synthesized CdS_xSe_{1-x} nanosheets in area A. (a) SEM image of the CdS_xSe_{1-x} nanosheets. (b-c) TEM image of an individualCdS_xSe_{1-x} nanosheet. (d) HRTEM image of the CdS_xSe_{1-x} nanosheet, taken from the area indicated by the red ellipse in part c.

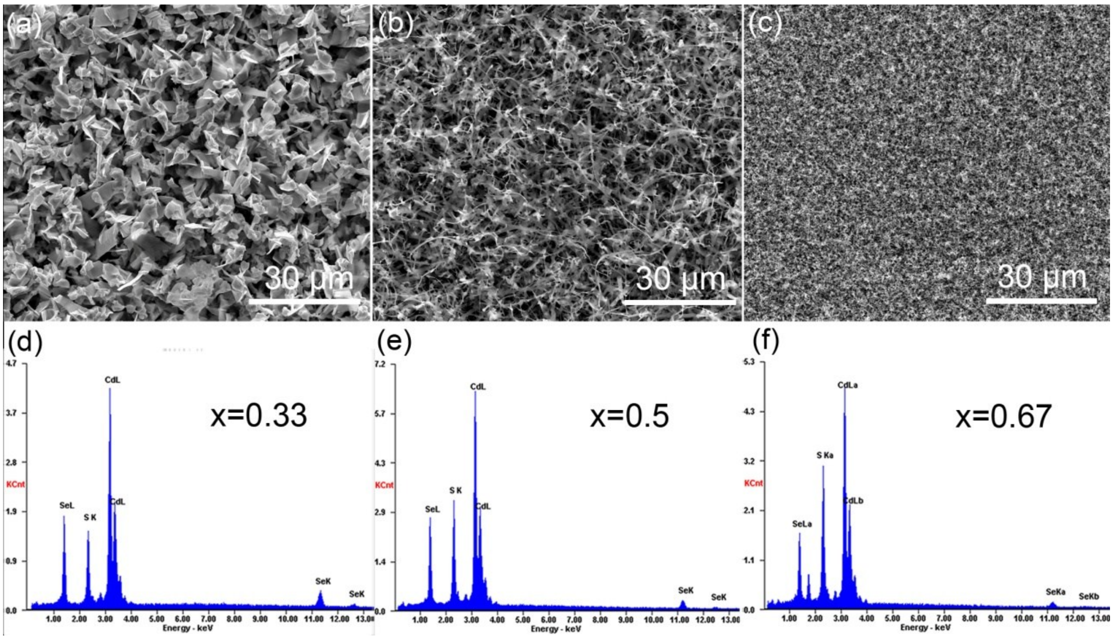

Fig. S2 Characterization of the synthesized CdS_xSe_{1-x} nanostructures. (a-c) SEM image of as-synthesized CdS_xSe_{1-x} nanostructures in different regions. (d-f) EDS spectra of as-synthesized CdS_xSe_{1-x} nanostructures, corresponding to the samples of A, B, and C, respectively.

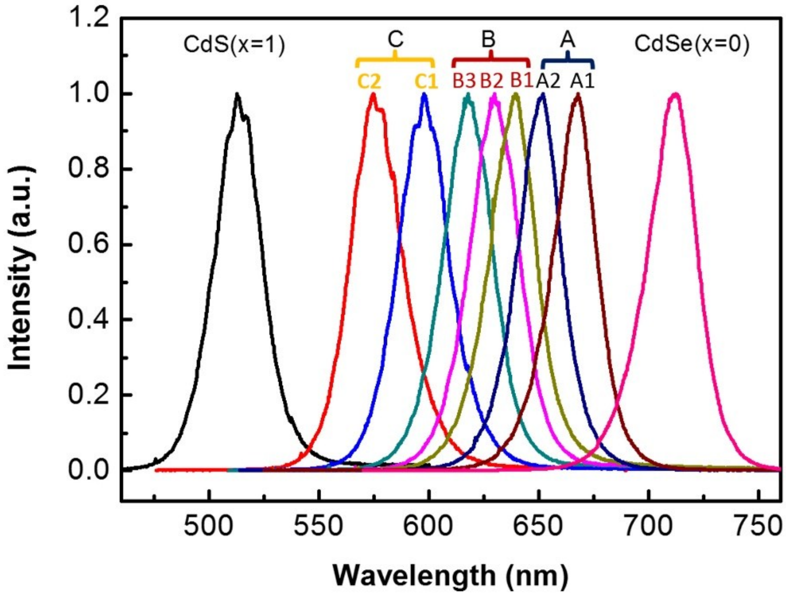

Fig. S3 PL spectra of the CdS_xSe_{1-x} nanostructures in area A, B and C. The corresponding peak wavelengths are 670 and 650 nm (area A), 638, 629 and 618 (area B), 598and 575nm (area C). The peak of 708 and 510 nm are corresponding to CdSe and CdS reference sample.

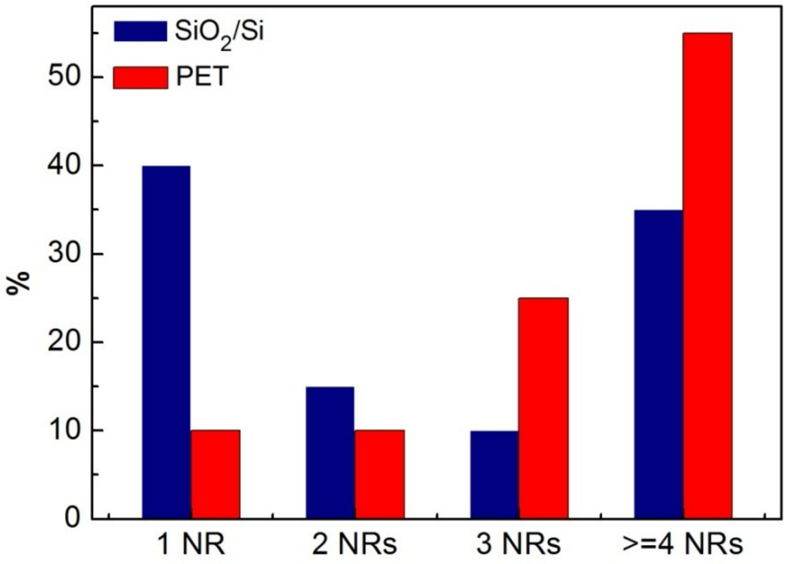

Fig. S4 A statistical chart about different number of CdS_xSe_{1-x} nanoribbons on SiO_2/Si and PET substrate devices (The total number of active devices are 20, respectively).

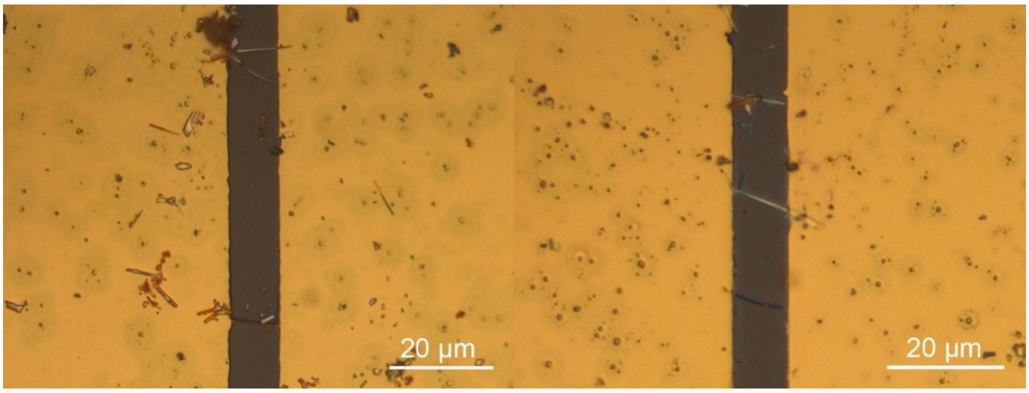

Fig. S5 Optical images of the three CdS_xSe_{1-x} nanoribbons on PET substrate.

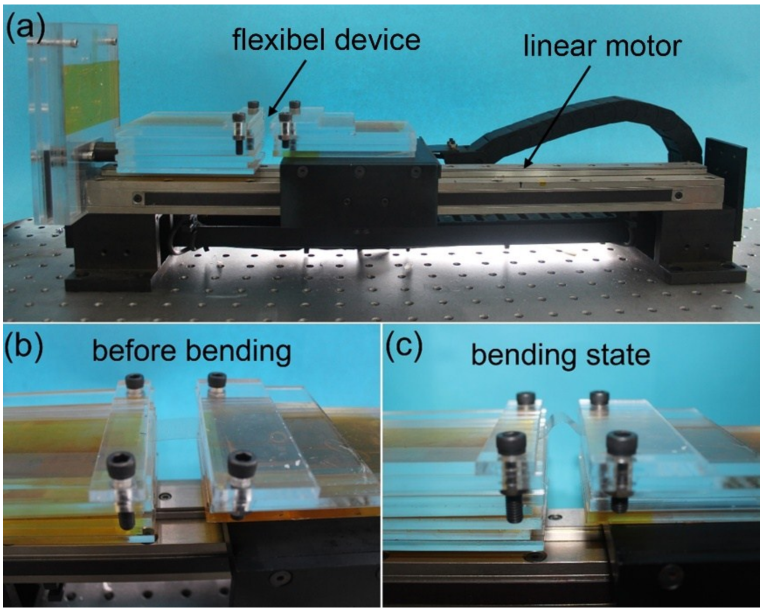

Fig. S6 The endurable testing equipment based on an automatic linear motor. Typical photograph of (a) the whole equipment, (b) before bending and (c) at bending state.

Table S1 Comparison of the performance for the CdS_xSe_{1-x} NR on PET and previous similar photodetectors (Abbreviations: NW, nanowire; PI, Fexible polyimide; PET, flexible polyethylene terephthalate; NR, nanoribbon)

Materials	Substrate	Wavelength of Light	Bias(V)	I_{ligh}/I_{dark}	Responsivity ($A.W^{-1}$)	Rise/decay Time	Ref.
CdS NWs	PI	470 nm	2	2500	-	0.4s/0.4s	[S1]
CdS_xSe_{1-x}NW	SiO_2/Si	400-600 nm	1	2.7×10^6	-	0.3s/1s	[S2]
CdS_xSe_{1-x}NR	SiO_2/Si	515 nm	4	$\sim 10^6$	1.16×10^{3}	30ms/90ms	[S3]
P_3HT:CdSe NW	PET	white light	3	>500	-	~10ms/10ms	[S4]
Layered InSe	PET	633nm	10	3.9	-	~50ms	[S5]
CdSe plate	mica	450nm	5	-	5.0×10^2	24ms /24ms	[S6]
CdS_xSe_{1-x}NR	PET	405nm	5	4×10^6	$\sim 1.24\times10^3$	0.56s/0.8s	This work

Table S2 The specific values of the photoresponsivity of the representative three nanoribbons on flexible PET substrate device under different light intensity illumination conditions

Light power intensity	Photocurrent(A)	Effective illuminated area (μm^2)	Responsivity ($A.W^{-1}$)
11.02 $\mu m/cm^2$	1.18×10^{-9}	13.44	8.01×10^2
20.84 $\mu m/cm^2$	3.50×10^{-9}	13.44	1.24×10^3
2.43 mw/cm^2	2.82×10^{-7}	13.44	8.63×10^2
13.82 mw/cm^2	1.95×10^{-6}	13.44	1.05×10^3
21.76 mw/cm^2	2.94×10^{-6}	13.44	1.01×10^3
31.92 mw/cm^2	4.16×10^{-6}	13.44	9.75×10^2

In this experiment, the fixed laser light area is about 1 mm^2, and the channel width and length are about 8 μm and 100 μm for the metal pad, respectively. However, the CdS_xSe_{1-x} NRs as the building block in our SiO_2/Si and PET substrate devices, so the effective illuminated area (S) of the representative three nanoribbons on PET substrate device is the real area of the three nanoribbons on the device channel. The average width of the three nanoribbons is about 0.56μm, the width of the device channel is 8 μm, so we can obtain the effective illuminated area (S) of PET substrate device is about 13.44 μm^2.

Reference:

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[S6] D. D. Zhu, J. Xia, L. Wang, X. Z. Li, L. F. Tian and X. M. Meng, *Nanoscale*, 2016, **8**, 11375.