Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Depression of ambient effect in multilayer InSe transistor and a strategy toward to stable 2D-based optoelectronic applications

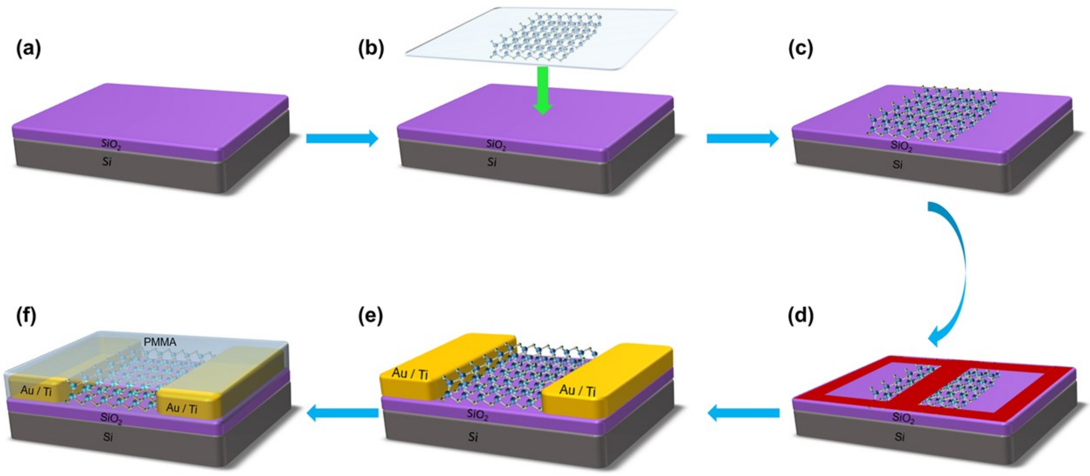

Fig. S1. The process of fabricating multilayer InSe FETs. (a) Prepare and clean the Si/SiO_2 wafer as a substrate. (b) Transfer the InSe flakes from bulk InSe crystals using Scotch tape. (c) The InSe flake is successfully transferred to the substrate by mechanical exfoliation. (d) A shadow mask is placed onto the InSe flake under the microscope to define the channel and electrodes. (e) The Ti/Au electrodes are deposited by electron beam evaporation. (f) PMMA layer is coated on the surface of the multilayer InSe FET.

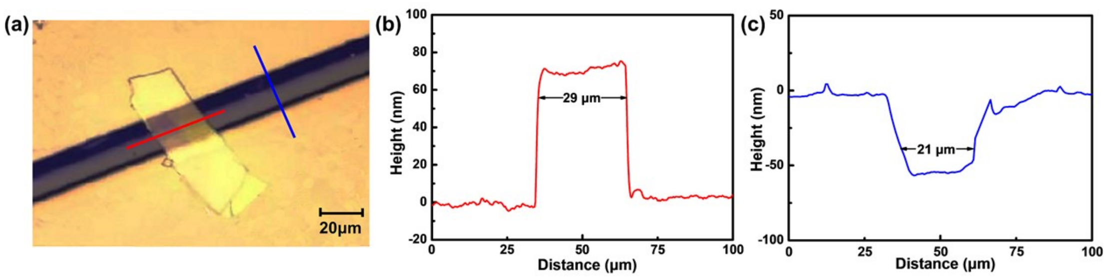

Fig. S2. (a) Optical microscope image of the InSe FET, scale bar is 20 μm. (b) The thickness of InSe film in the channel, corresponding to the red line in figure (a). (c) The thickness of Ti/Au electrodes through the channel of InSe FET, corresponding to the blue line in figure (a).

Table S1. Negative photoconductivity observed in different systems and its mechanism

Material	Dim	NPC mechanism	References
InAs nanowire	1D	hot carrier trapping	[1]
InAs nanowire	1D	hot carrier trapping	[2]
InAs nanowire	1D	defect states in the native oxide layer	[3]
graphene	2D	photoinduced impurity scattering	[4]
$FePS_3$	2D	the competition between hole concentration and mobility	[5]
WS_2 with Au NPs	2D	interfacial trapping and detrapping of electrons	[6]
ReS_2/h-BN/MoS_2	2D	charge transfer between the floating layer and the conduction channel	[7]
$Cr_2Ge_2Te_6$	2D	hot carrier trapping	[8]
$SnSe_2$	2D	the competition between hole concentration and mobility	[9]
carbon nanotube	1D	/	[10]
InSe	2D	the competition between hole concentration and mobility	this work

Table S2. Comparison of responsivity (R) and detectivity (D*) values for the different InSe-based photodetectors

Structure	λ (nm)	R (A/W)	D* (Jones)	References
InSe	633	157	1.07×10^{11}	11
InSe/Graphene	500	60	/	12
InSe	254	5.68×10^{4}	~1×10^{13}	13
	490	3.57×10^{4}	~1×10^{13}	
	700	3.06×10^{4}	~1×10^{13}	
	850	2.98×10^{4}	~1×10^{12}	
InSe/Graphene	532	0.101	/	14
InSe	808	4.90×10^{-6}	/	15
InSe	325	1.80×10^{7}	1.10×10^{15}	16
	532	2.40×10^{6}	1.40×10^{14}	
InSe	365	0.369	8.00×10^{12}	17
	685	0.244	2.56×10^{11}	
InSe	450	633.33	3.17×10^{10}	this work

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