Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.


# Supplementary Information

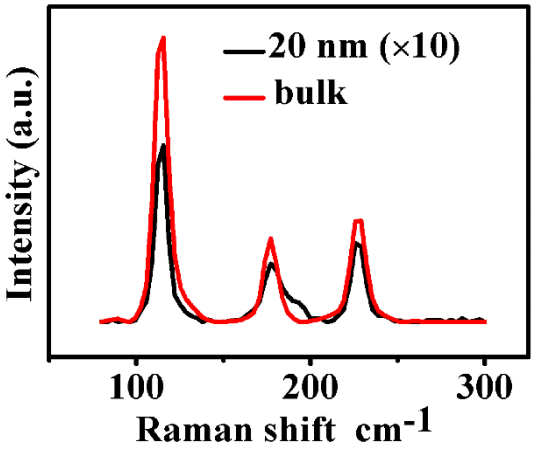


**Fig. S1** Raman spectroscopy of 20 nm and bulk InSe.

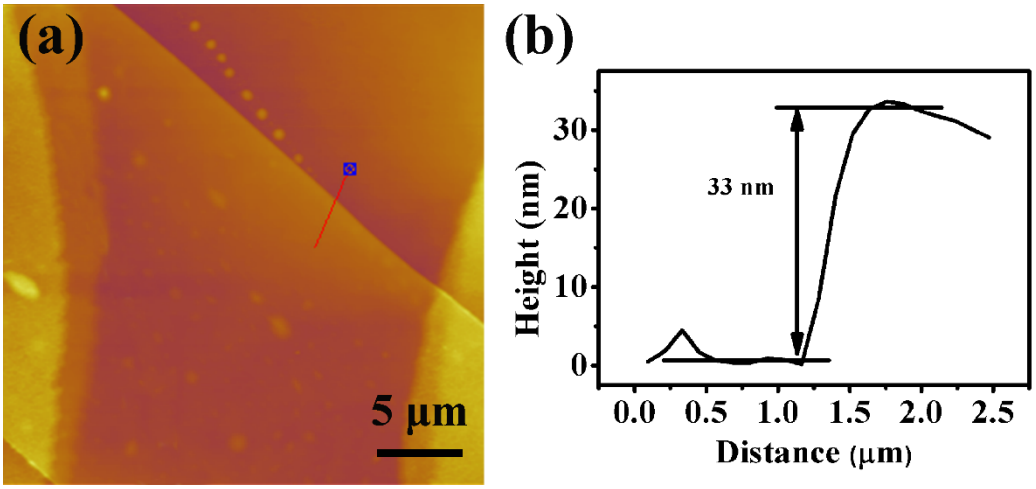


**Fig. S2** (a) The AFM image and (b) AFM height profile multilayer InSe FETs (33 nm).

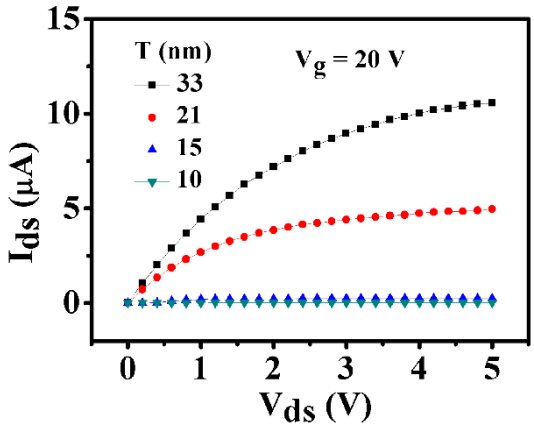


**Fig. S3** Output curves as function of the InSe thickness.

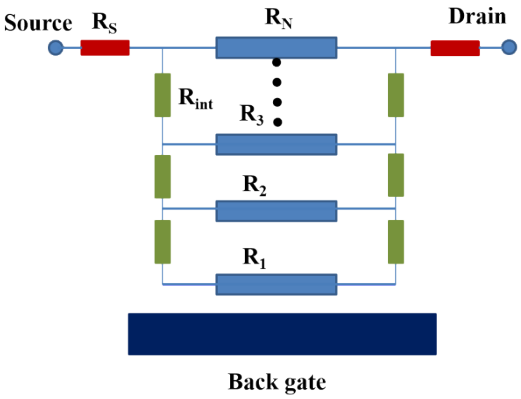


**Fig. S4** Resistor network model of multilayer InSe FETs.

The absence of sufficient gate field screening effect leads to a lower mobility in few layer thickness FETs, which can explains the sharp decrease in mobility below 33 nm. With the layer thickness increasing, the interlayer resistance will dominate the mobility. The current is injected form electrical contacts on the top, the finite interlayer resistance and edge resistance will force the current to flow in all layers, which are not gated by gate field screening effect. Such effect will degrade the mobility of thicker layer than 33 nm. Hence, taking all factors into consideration, there is a peak mobility value arising at a finite layer thickness.

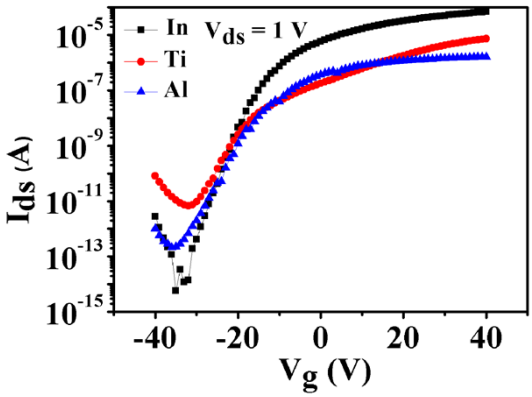


**Fig. S5** Logic transfer of back-gated 33 nm thin-film InSe back-gated FETs with Al, Ti and In metal contacts for $V_{ds}$ = 1 V.