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Supporting Information

Monolayer $MoSe_2$/NiO van der waals heterostructure for infrared light-emitting diode

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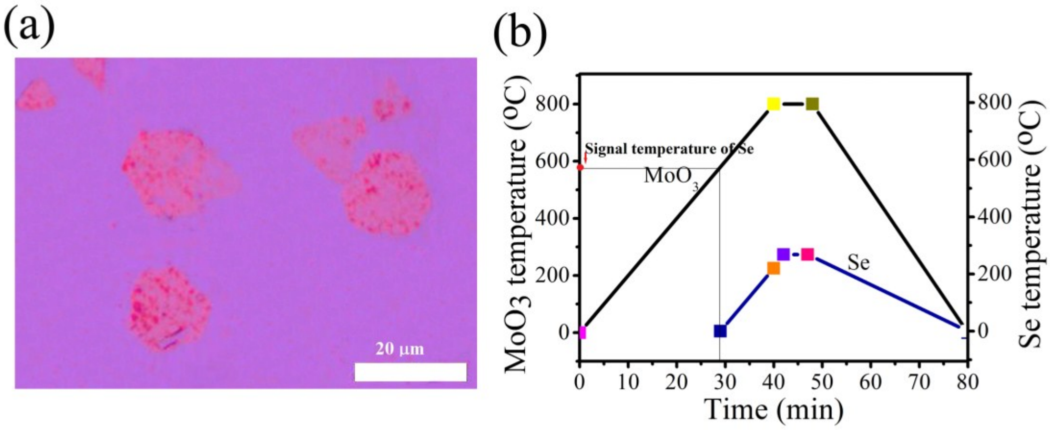

Figure S1. (a) The as-transferred monolayer n-$MoSe_2$/p-NiO van der waals heterostructure. (b) The temperature curve of MoO_3 and Se powder in the synthesis process of $MoSe_2$.

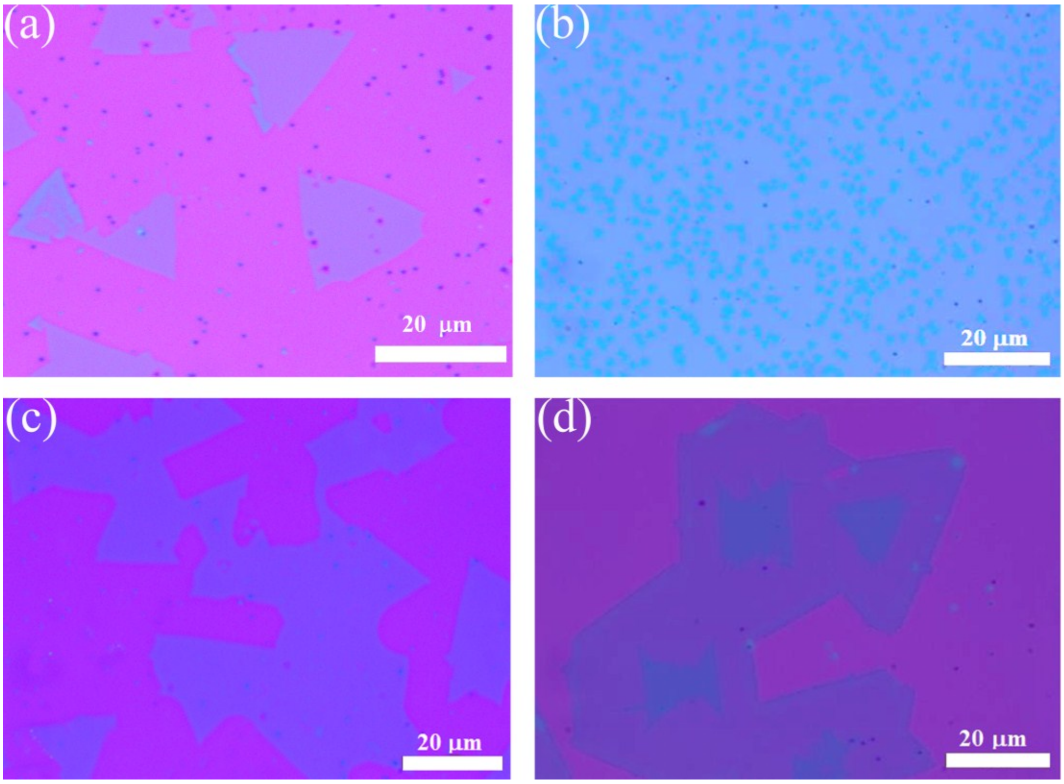

Figure S2. (a) The monolayer $MoSe_2$ interluded with pole synthesized at the signal temperature of 560 ^{o}C. (b) The monolayer $MoSe_2$ with large nucleation density synthesized at the signal temperature of 600 ^{o}C. (c) The large tract of $MoSe_2$ monolayer. (d) The large tract of $MoSe_2$ bilayer.

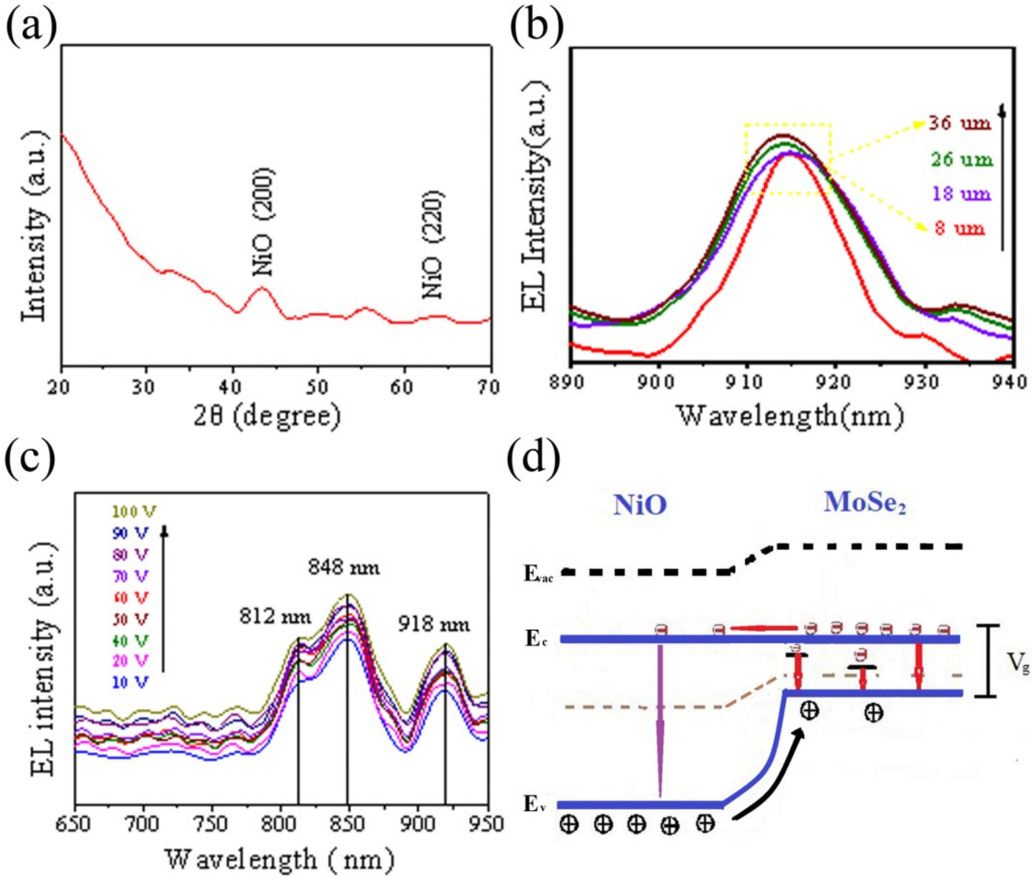

Figure S3. (a) The X-ray diffraction pattern of NiO thin film. (b) The EL peak at 918 nm of monolayer n-$MoSe_2$/p-NiO LED changes with relation to the increase of $MoSe_2$ size. (c) The EL intensity of n-$MoSe_2$/p-NiO changes with relation to the increase of positive bias voltage. (d) The energy band diagram of n-$MoSe_2$/p-NiO LED under large positive bias.