Journal of Pharmaceutical Chemistry and Pharmacology
Extended Abstract
2020
Vol. 1, Iss. 1

The international debate on Two dimensional lateral complicated struture

Duan Xidong
Hunan University, China

Two-dimensional layered materials such as garphene, MoS_2 and WSe_2 have attracted considerable interest in recent times as semiconductor after Si and becoming an important material platform in condensed matter physics and modern electronics and optoelectronics. The studies to date however generally rely on mechanically exfoliated flakes which always be limtited to simple 2D materals, especially 2D lateral complicated structure can not be perpared through exfoliation strategy. Much like the traditional semiconductor technique, complicated structure such as controlling the space distribution of composition and electronic structure of two dimensional semiconductor material is essential to construct all modern electronic and optoelectronic devices, including transistors, p–n diodes, photovoltaic/photodetection devices, light-emitting diodes and laser diodes. And many physics phenomenon can only appear in more complicated structure. To fully explore the potential of this new class of materials, it is necessary to develop rational synthetic strategies of two dimensional lateral complicated struture, such as lateral heterostructure, multiheterostructure, superlattice, quantum well etc., With a relatively small lattice mismatch (~4%) between MoS_2 and $MoSe_2$ or WS_2 and WSe_2, it is possible to produce coherent MoS_2–$MoSe_2$ and WS_2–WSe_2 heterostructures through a lateral epitaxial process (Fig. 1a). Our studies indicate that simple sequential growth often fails to produce the desired heterostructures because the edge growth front can be easily passivated

after termination of the first growth and exposure to ambient conditions. To retain a fresh, unpassivated edge growth front is important for successive lateral epitaxial growth. To this end, we have designed a thermal CVD process that allows in situ switching of the vapour-phase reactants to enable lateral epitaxial growth of single- or few-layer TMD lateral heterostructures. We used this technique to realize the growth of compositionally modulated MoS_2– $MoSe_2$ and WS_2–WSe_2 lateral heterostructures. From the Fig. 1 b,c,d,e we can see the formation of WS_2–WSe_2 lateral heterostructures clearly. The WS_2–WSe_2 lateral heterostuctures with both p- and n-type characteristics can also allow us to construct many other functional devices, for example, a CMOS inverter. Fig. 1g is the optical image of the invert constructed using the WS_2–WSe_2 lateral heterostuctures and the curves of the output–input and the voltage gain. The voltage gain reaches as large as 24.

Note : This work is partly presented at 30th World Nano Conference | May 20-21, 2019 held at Zurich, Switzerland