**Transition metal dichalcogenides for optoelectronic devices**

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Recently, transition metal dichalcogenides (TMDs) including MoS2 and WS2 have attracted increasing attention because of their great potential as semiconductors of electronic devices such as field-effect transistors, organic photovoltaics, memory, logic, and energy storage devices. We will introduce three kinds of fabrication methods for TMDs.

First, TMD layers with a polycrystalline structure were synthesized by a chemical deposition method using uniformly spin-coated (NH4)MoS4 and (NH4)WS4 precursor solutions. TMDs were used in order to enhance the stability in air comparing to poly(3,4-ethylenedioxythiophene): poly(styrenesulfonate) (PEDOT:PSS). Organic light emitting diodes (OLEDs) and organic photovoltaic cells based on TMD showed two to six times longer stability in air compared with PEDOT:PSS based devices. Furthermore, TMD layers were applied as the hole transport layer as well as the template for highly polarized OLEDs. The MoS2 nanosheets were patterned by rubbing/ion-beam treatment. The use of patterned MoS2 nanosheets not only tuned the polarization of the OLEDs but also dramatically improved the device performance as compared with that of devices using untreated MoS2.

Second, the backplane circuitry of a flexible display, comprising an array of transistors responsible for turning the individual OLED pixels ON and OFF, was fabricated using a metal-organic CVD (MOCVD)-grown bilayer MoS2 film on a 6-mm-thick ultrathin polyethylene terephthalate. Last, TMDs were synthesized using a direct synthesis method on a p-type Si wafer via thermolysis. The application of TMDs synthesized by last two methods also will be shown in this talk.