CHEMICAL VAPOUR DEPOSITION OF WS_2 MONOLAYERS

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Transition metal dichalcogenides (TMD) like WS_2 have attracted considerable attention because of their interesting physical properties and potential applications in various opto-electronic devices. Monolayer WS_2 has two excitonic bands named *A* and *B* bands due to spin-orbit splitting. The value of spin-orbit splitting of the valence band in WS_2 is 425 meV.

WS_2 monolayers were grown by chemical vapour deposition (CVD) method on a Si/SiO_2 substrate using WO_3 and S precursors. In two-zone furnace S zone was at 200 °C and WO_3 zone was at 850 °C. N_2 and H_2 (9%) mixed gas was used as a carrier gas and the Si/SiO_2 was positioned face-down next to WO_3 precursor. This growth process produced uniform mostly triangular shaped WS_2 monolayer domains, although several different shapes sometimes appeared (Fig.1). The size of these areas ranges from couple of micrometres up to several tens of micrometres. Influence of the zone temperatures, gas flow and gas percentages on the growth of WS_2 monolayers was studied and further optimization to get bigger monolayer areas is in progress.

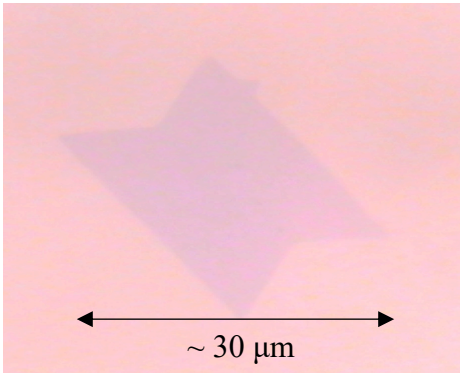

Fig. 1 CVD grown WS_2 monolayer

WS_2 monolayers were characterized using Raman scattering, room-temperature photoluminescence (PL) and reflectance contrast (RC) analysis. PL spectra show *A* band with high intensity, which indicates good quality monolayers. The *A* band peak maximum varies for different WS_2 monolayer domains in the range of 1.94 – 1.98 eV, showing different tensile strain values in CVD grown WS_2 monolayers. The uniformity of single WS_2 monolayer domains was studied using PL images of the integrated peak intensity.

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