Optical properties of large area WS2 grown by chemical vapor deposition

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Transition metal dichalcogenides (TMDs) have attracted great attention for fundamental physics and possible application as optoelectronic devices [1-5]. Monolayers of TMDs are direct gap semiconductors with optical transition in inequivalentat K and K´ valleys and distinct optical selection rules due to the combination of spin-orbit interaction and broken inversion symmetry. As a consequence, optical excitation with circularly polarized light results in circularly polarized emission. Actually, recent studies for TMDs have evidenced important valley polarization degree and large excitonics effects as well particularly at lower temperatures[1-5].

In this work, we have investigated optical properties from large area monolayers of WS_2 on 295nmSiO_2/Si grown by Van der Waals Epitaxy Chemical Vapor Deposition. Particularly, we have investigated polarization resolved photoluminescence (PL) spectra for different light excitation intensities and temperatures using a 532 nm solid state laser. The σ+ and σ- light excitation and detection were obtained using appropriate quarter wave plates and linear polarizers. At lower temperatures, we have observed different PL peaks for the WS_2 monolayer. The temperature and laser power dependence of PL spectra evidences that the observed peaks are associated to neutral (X), charged excitons (X^-) and biexcitons (XX). Therefore, our results reveal important many-body interactions in atomically thin WS_2 semiconductor.

Keywords: WS2; photoluminescence;biexcitons biexcitons

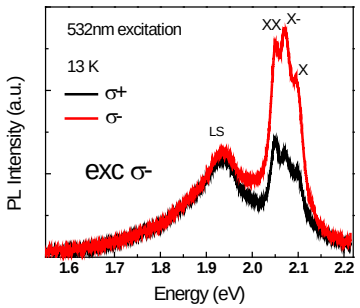

Fig. 1. Polarization resolved PL at B=0T.

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