**[Session F15: 2D Materials (Semiconductors) -- Optical Properties I](http://meetings.aps.org/Meeting/MAR19/Session/F15)**

11:15 AM–2:15 PM, Tuesday, March 5, 2019

**Abstract: F15.00002 : Nearly 90% circularly polarized emission in monolayer heterogeneous WS2 single crystals by chemical vapor deposition (CVD)\***

11:27 AM–11:39 AM

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Monolayer transition metal dichalcogenides (TMDCs) are promising materials for valleytronic applications because the two inequivalent valleys in the Brillouin zone. We report here novel optoelectronic properties of heterogeneous domains in CVD-grown monolayer WS2 single crystals. Spatially resolved PL, Raman, X-ray photoelectron spectroscopy and Kelvin probe force microscopy images revealed the formation of homojunctions in these single crystals, which implied a direct correlation between the chemical stoichiometry and the optoelectronic heterostructure. Conductive atomic force microscopy (AFM) measurements revealed nanoscale distributions of electronically active defects in the heterogeneous WS2, and the local defect density was found to be inversely proportional to the local PL intensity. Additionally, by optically pumping WS2 with CPL and measuring the resulting spatially resolved CP emission (Pcirc) at room temperature (RT) and low temperature (80K), we found significant Pcirc intensities even at RT, and Pcirc was inversely correlated with the defect density. At 80K, the degree of circularly polarized emission in low-defect domains was found to approach ~ 90%, suggesting nearly perfect valley polarization.

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