

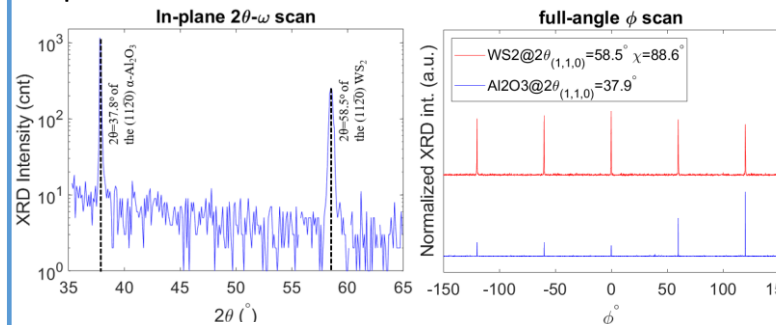


**Sample details:** The  $WS_2$  layer was grown via MOCVD on a 2" double-side polished C-plane sapphire substrate.

**Shipping:** The sample is face down in the container and sealed in nitrogen filled glove box. The mark "R" was inscribed on backside of substrate near the major flat.

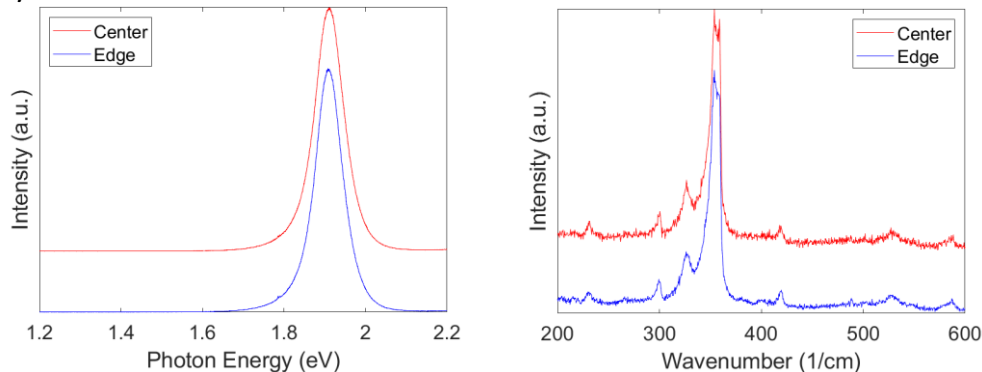
- Approximate positions where AFM micrographs were taken
- + Approximate positions where Raman/PL spectra were measured

### In-plane XRD



In-plane XRD shows  $WS_2$  monolayer is epitaxially orientated to c-plane Sapphire with  $(1120)$  of  $WS_2$  //  $(1120)$  of  $\alpha-Al_2O_3$

### PL/Raman



PL demonstrates relatively strong luminescent peak at  $\sim 1.9$  eV at both the center and the edge. The Raman spectra is consistent with a monolayer  $WS_2$  film.

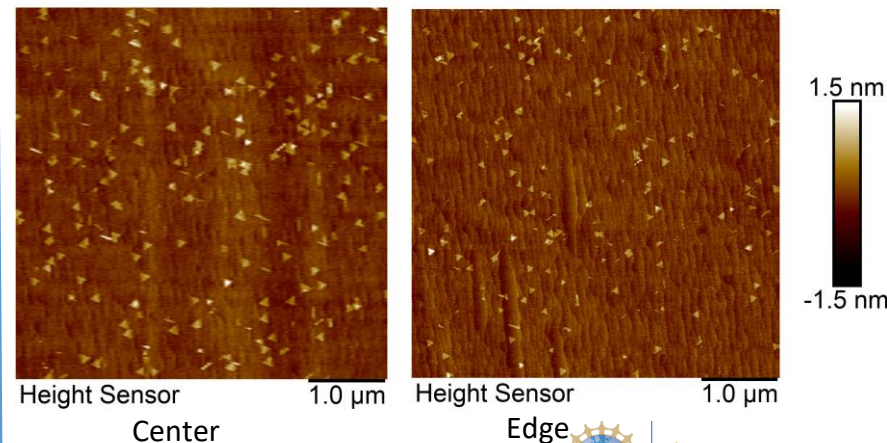
### PL conditions:

Laser wavelength: 532 nm  
Laser – 4 mW Acquisition time – 5 s (2 times)  
Objective – 100X Grating – 300 gr/mm

### Raman conditions:

Laser wavelength: 532 nm  
Laser – 4 mW Acquisition time – 30 s (3 times)  
Objective – 100X Grating – 1800 gr/mm

### AFM



AFM shows the film is fully coalesced monolayer with a few bilayers (triangular).