Control over Morphology and Excitonic Disorder in WSe_2 Crystals

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Recent developments have shown that chemical synthesis is a powerful tool for controlling the size, shape, and composition of two-dimensional (2D) crystals with broad implications for their implementation in optoelectronic and quantum devices. However, most gas-phase reaction methods are not conducive to precise manipulation of the 2D crystal edge structure. Here we demonstrate a salt-assisted low-pressure chemical vapor deposition method, which enables growth of 2D WSe_2 monolayers whose edge morphology can be tuned from straight, to sawtooth, to fractal-like by adjusting the ratio of WO_3 to NaCl. We discuss the volatility of the metal precursor and its role in dictating the edge structure, defect density, and excitonic environment within the as-grown crystals. These studies provide important insight into new 2D crystal growth modes and synthetic strategies for producing crystals with unique structures and optoelectronic properties.