1D transition-metal dichalcogenide heterostructures as single-photon emitter candidates

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Numerous exfoliation, fabrication, and gas-phase synthetic strategies have been used to prepare 2D transition-metal dichalcogenide (TMD) crystals and their associated devices. To fully exploit these crystals' exceptional electronic, optical, and magnetic properties, it is necessary to precisely control their dimensionality, edge structure, and strain state, and also the structure of any vertical or lateral interfaces in them. Achieving these goals through synthesis is a compelling but challenging prospect. Here we present progress towards directed growth of heterostructured TMD nanoribbons with the goal of achieving precise control over the type, location, and extent of lateral heterointerfaces in these crystals. Careful switching of chalcogen sources at a desired time during the chemical vapor deposition reaction permits growth of crystals comprised of two TMD components. The second component may grow axially or longitudinally relative to the first component. Spatial control over the placement of heterointerfaces, defects, or strain will provide new avenues for tuning the optoelectronic properties of these crystals and will permit the design of advanced devices, including candidate single-photon emitters.