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(G*) Stacking order domains in twisted transition metal dichalcogenides

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Vertically stacking two-dimensional (2D) materials allows for the fabrication of heterostructures with properties not present in their constituent layers, presenting an opportunity to study new quantum phenomena. In twisted bilayers of hexagonal 2D materials, the formation of a moiré pattern can lead to electron confinement and flat bands. In bilayers of hexagonal transition metal dichalcogenides, moiré patterns have been observed at twist angles within approximately three degrees of parallel alignment. At smaller twist angles, in-plane relaxation of the moiré pattern produces a network of stacking order domains bound by domain walls consisting of shear solitons. In these systems, this deformation has been observed to result in ferroelectricity. Additionally, topological edge states have been predicted to exist at the domain walls. In this work, we use scanning tunneling microscopy (STM) and spectroscopy (STS) to study domain networks in mechanically assembled WS_2 homobilayers. We report a technique for fabricating rotationally controlled homobilayers with sufficiently clean interfaces for STM measurement. Using STM, we observe triangular stacking order domains. In spectroscopic measurements, the domains show variation in the local density of states. These results are discussed in light of the anti-symmetric ferroelectricity predicted in these materials.

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