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Study of the Effects of Modified Interlayer Interaction on the Electronic Properties of 1*T*-TaS_2

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Within the class of layered transition metal dichalcogenides, TaS_2 has attracted intense research interest in recent years, mainly aimed at understanding the origin of its low temperature insulating properties as well as other phenomena such as pressure induced superconductivity.
In this work, we have investigated this material using primarily scanning tunnelling microscopy (STM) and angle resolved photoemission spectroscopy (ARPES) and present several findings regarding the influence of the interlayer stacking order of the in-plane charge density wave (CDW) on its properties.
Firstly, we present combined ARPES and STM measurements which we believe are the first observation of differences in the electronic structure originating from differences in the stacking of the CDW in the top layer. In addition to static ARPES, we have also performed time resolved measurements on different terminations with the goal to highlight differences in the electronic response.
Secondly, we report the occurrence of a metallic phase at the surface of the sample previously only seen after external stimulation in samples in equilibrium as well. From analysis of STM images, we conclude that the metallic character of this phase is likely caused by an irregular stacking of the surface CDW. We speculate that the presence of this phase in our samples is due to doping by sulphur vacancies of which we provide high quality electronic structure measurements.
Lastly, when applying strain to the sample using a sample holder of our own design, we find a metallic quasi-particle peak in certain regions of the sample. With support from both theory and x-ray diffraction measurements, we attribute this behaviour to a change in the bulk stacking order of the CDW in the strained sample, specifically a weakening of the normal bilayer structure.

Jury:
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