In situ off-axis electron holography of electrically biased two-dimensional transition metal dichalcogenides

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Abstract

Transition metal dichalcogenides (TMDs), such as MoS2 and WSe2, have attracted much attention in recent years due to their enormous potential for applications in nanoelectronic devices. However, the electrical properties of mono- or few-layer TMDs can be influenced strongly by the presence of contamination and defects, as well as by their interfaces to three-dimensional metal contacts.
Off-axis electron holography allows the projected electrostatic potential of a nanoscale specimen to be measured in the transmission electron microscope. The technique can therefore be used to correlate the structural and compositional properties of TMDs with their electronic properties by performing in situ electrical biasing experiments. Here, we present first results and discuss the challenges and prospects of performing electron holography on individual electrically biased MoS2 devices. The electrical contacts are patterned using electron beam lithography on a SiN membrane. In order to provide a vacuum reference wave for off-axis electron holography, the MoS2 flakes are partly suspended over holes in the SiN membrane.