



ID de Contribution: 514

Type: Poster

Gate-free doping of transition metal dichalcogenide monolayer using ferroelectric hexagonal boron nitride interface.

For the past few years, 2D ferroelectric materials have attracted strong interest for their potential in future nanoelectronics devices. The recent discovery of 2D ferroelectricity in twisted layers of insulating hexagonal boron nitride [1-3], one of the most used 2D materials, opened the route to its integration into complex van der Waals heterostructures combining hybrid properties. Indeed, when two hBN flakes are stacked with a twist angle close to 0° , spontaneous out-of-plane electric polarization occurs on large reconstructed triangular domains with AB and BA arrangements [4]. Here we show that opposite polarizations in ferroelectric domains of a folded hBN layer can imprint local n and p doping in a semiconducting transition metal dichalcogenide WSe₂ monolayer. We demonstrate that WSe₂ can be used as an optical probe of ferroelectricity in hBN and show that the doping density and type can be controlled with the position of the semiconductor with respect to the ferroelectric interface. Our results establish the ferroelectric hBN/WSe₂ van der Waals stacking as a promising optoelectronic structure.

References:

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Classification de Session: Session Poster 1: MC3, MC5, MC6, MC11, MC13, MC15, MC16, MC18, MC19, MC25, REDP, posters hors MC

Classification de thématique: MC19 Hétérostructures et interfaces de basse dimensionnalité