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Impact of sulfur vacancies on the light emission and transport properties of MoS2 structures

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In the last decade, the rise of monolayer (ML) transition metal dichalcogenides (TMDs) has changed the paradigm for the coupling of two-dimensional materials to a well-established platform without the constraints imposed by epitaxies such as crystal-lattice match or chemistry compatibility. The employment of semiconducting monolayers has resulted in several applications in different fields such as electronics, valleytronics, energy storage, photovoltaics, light detection and chemical sensing.
Among TMDs, molybdenum disulfide (MoS2) has been demonstrated to be the most versatile material for optoelectronic and photonic applications due to its layer-dependent optical properties. In the monolayer regime, MoS2 exhibits a direct optical bandgap in the visible range, which makes it a good candidate for novel applications ranging from photonics to optoelectronics.
In this work, we highlight the impact of sulfur vacancies in two complete different MoS2 based systems:
1- we univocally demonstrate the role of sulfur vacancies in mechanically exfoliated multilayer flakes for the engineering of infrared light emissions, with possible applications in Telecom/Datacom.
2- we report the unexpected electron transport suppression in monolayer MoS2 encapsulated graphene field-effect transistor, caused by the presence of sulfur vacancies in the MoS2 monolayer.

Type of presence

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