Plasma doped 2D materials for advanced electronics

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Abstract

Two dimensional transition metal dichalcogenides (TMDCs) have shown promise as a class of semiconductors with unique properties. As atomically thin semiconductors with bandgap sizes that vary with the number of layers in some cases, 2D TMDCs have opened up the potential for novel opto-electonic applications. A significant challenge in realizing these applications is the ability to make reliable, low-resistance electrical contact to 2D TMDCs. This work focuses on doping 2D TMDCs using plasma processes in order to tune the work function and improve electrical contact. Chlorine plasma treatments have been shown to lower resistance and p-dope 2D materials and is employed to make improved electrical contact to 2D TMDC devices. Characterization techniques such as Raman microscopy and Kelvin probe force microscopy are employed to study the effects of doping and measure shifts in work function. In addition to enabling applications ranging from FETs to sensors, the improvement of electrical contact to 2D TMDCs will also enable the ability to perform measurements of these materials at extremely low temperatures in order to probe quantum phenomena. This doping process may serve as a template for a scalable doping method for tuning 2D material properties for advanced electronic applications.

References

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