# Electrodeposition of TMDC 2D-materials on Graphene

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The development of scalable techniques to make two-dimensional transition metal dichalcogenides (2D-TMDC) material heterostructures is a major obstacle that needs to be overcome before these materials can be implemented in device technologies. Electrodeposition is an industrially compatible deposition technique that offers unique advantages in scaling 2D heterostructures. In this work, we demonstrate both the ability of electrodeposition the grow atomic layers of $MoS_2$ and $WS_2$ on patterned graphene electrodes as well as lateral growth of said 2D materials over an insulator resulting in promising electrical characteristics for photodetectors and transistors. This paves the way towards future possibilities such as electrodepositing different TMDCs to form lateral heterostructures of 2D materials and graphene, such as creating novel p-n-p or Schottky junction in a single electrodeposition experiment [1-4].

## References

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## Figures

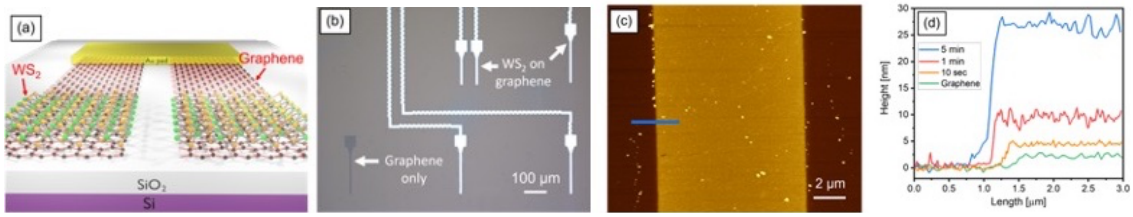


**Figure 1:** (a) A schematic illustration of $WS_2$ deposited on patterned graphene that is biased through Au contact pad. (b) An optical microscope image. (c) AFM topography images of $WS_2$ deposits on graphene for 1 minutes. (d) Line profiles showing total step height.

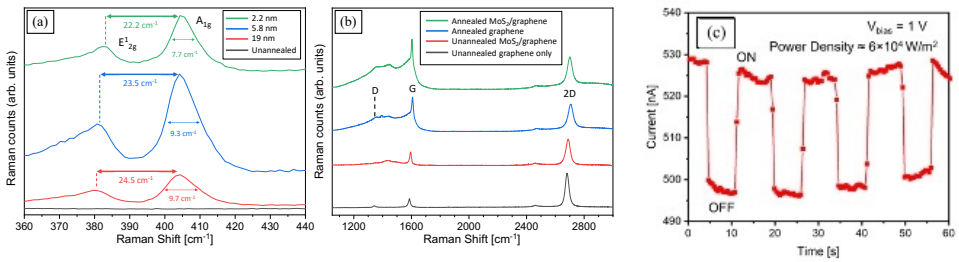


**Figure 2:** a) Raman spectra of $MoS_2$ with the separation between the $A_{1g}$ and $E^1_{2g}$ peaks reducing with deposition thickness. (b) Raman spectra of graphene showing the 2D peaks remain after annealing. (c) photo-illumination cycles showing induced photocurrent with a switching laser source