Electrodeposited TMDCs on graphene

Jiapei Zhang[1]
Yasir J Noori[1], Shibin Thomas[1], Nema Abdelazim[1], Sami Ramadan[2], Victoria Greenacre[1], Shaokai Song[1], Yisong Han[3], Richard Beanland[3], Gill Reid[1], Philip N Bartlett[1], Kees de Groot[1]

[1]*University of Southampton, Southampton, UK*
[2]*Imperial College, London, UK*
[3]*University of Warwick, Coventry, UK*
jz9u19@soton.ac.uk

Abstract

Transition metal dichalcogenides (TMDC) consist of a covalently bonded lattice. The van der Waals interactions between the layers allow the integration of very different materials without the constraints of crystal lattice matching. The development of scalable techniques to make two-dimensional transition metal dichalcogenides (2D-TMDC) material 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 the electrodeposition of few layer MoS_2, WS_2 and WSe_2 on graphene substrate. Through the characterisation techniques of Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM) and Raman spectroscopy, we demonstrate high quality and uniform electrodeposited TMDCs film on graphene.

References

[1] Y. J. Noori, S. Thomas, S. Ramadan, et al., IOP 2D Mater., 9 (2022).
[2] Y. J. Noori, S. Thomas, S. Ramadan, et al., ACS Appl. Mater. Interface, 12 (2020) 49786.
[3] N. Abdelazim, Y. J. Noori, S. Thomas, et al., Wiley Adv. Electron. Mater., (2021) 2100419.
[4] S. Thomas, V. Greenacre, et al., Chemical Communications, 57 (2021) 10194.

Figures

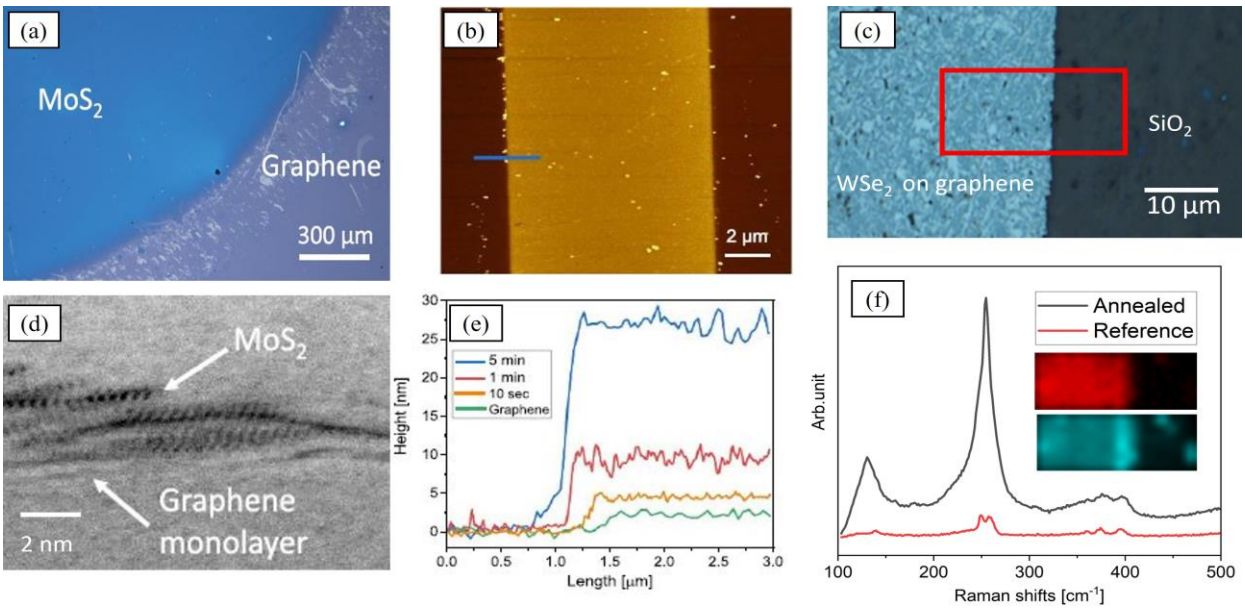

Figure 1: (a)Optical microscope image of electrodeposited MoS_2 on graphene. (b) AFM image of electrodeposited WS_2 on patterned graphene. (c) Optical microscope image of electrodeposited WSe_2 on patterned graphene. (d) TEM image of electrodeposited MoS_2 on graphene. (e)Height profile comparison of electrodeposited WS_2. (f) Raman spectrum of electrodeposited WSe_2 with the inset of Raman mapping of WSe_2 and graphene from top to bottom.