# Supporting information

# Electrodeposition of $MoS_2$ from Dichloromethane

Shibin Thomas[1], Danielle E. Smith[1], Victoria K. Greenacre[1], Yasir J. Noori[2], Andrew L. Hector[1], C. H. (Kees) de Groot[2], Gillian Reid[1] and Philip N. Bartlett[1,z]

[1]School of Chemistry, University of Southampton, Southampton, SO17 1BJ, UK

[2]School of Electronics and Computer Science, University of Southampton, Southampton, SO17 1BJ, UK

[z]E-mail: P.N.Bartlett@soton.ac.uk

**Precursor synthesis**

Tetrabutylammonium chloride (Sigma-Aldrich) and ammonium tetrathiomolybdate (Acros Organics) were used as received. Following reported literature,(1) ammonium tetrathiomolybdate (367 mg, 1.41 mmol) was dissolved in deionised water (10 mL) to form a red solution. A solution of tetrabutylammonium chloride (0.784 mg, 2.82 mmol) was slowly added dropwise; a red solid immediately precipitated. The red solid was isolated and washed with water (1x 2 mL) and isopropyl alcohol (1 x 2 mL) before being dried under vacuum and stored under $N_2$. Yield: 728 mg, 90%. Required for $C_{32}H_{72}MoN_2S_4$: C: 54.20, H: 10.23, N: 3.95%. Found: C: 53.92, H: 10.14, N: 4.05%. IR spectrum (Nujol/ $cm^{-1}$): 468sh (Mo=S). $^1$H NMR ($CDCl_3$): δ 0.99 (t, [3H], $J_{HH}$ = 7.3 Hz), 1.46 (m, [2H], $J_{HH}$ = 1.0 Hz), 1.6 – 1.7 (m, [2H]), 3.34 (m, [2H], $J_{HH}$ = 16.9 Hz). $^{95}$Mo NMR ($CD_2Cl_2$): δ = 2213 (s).

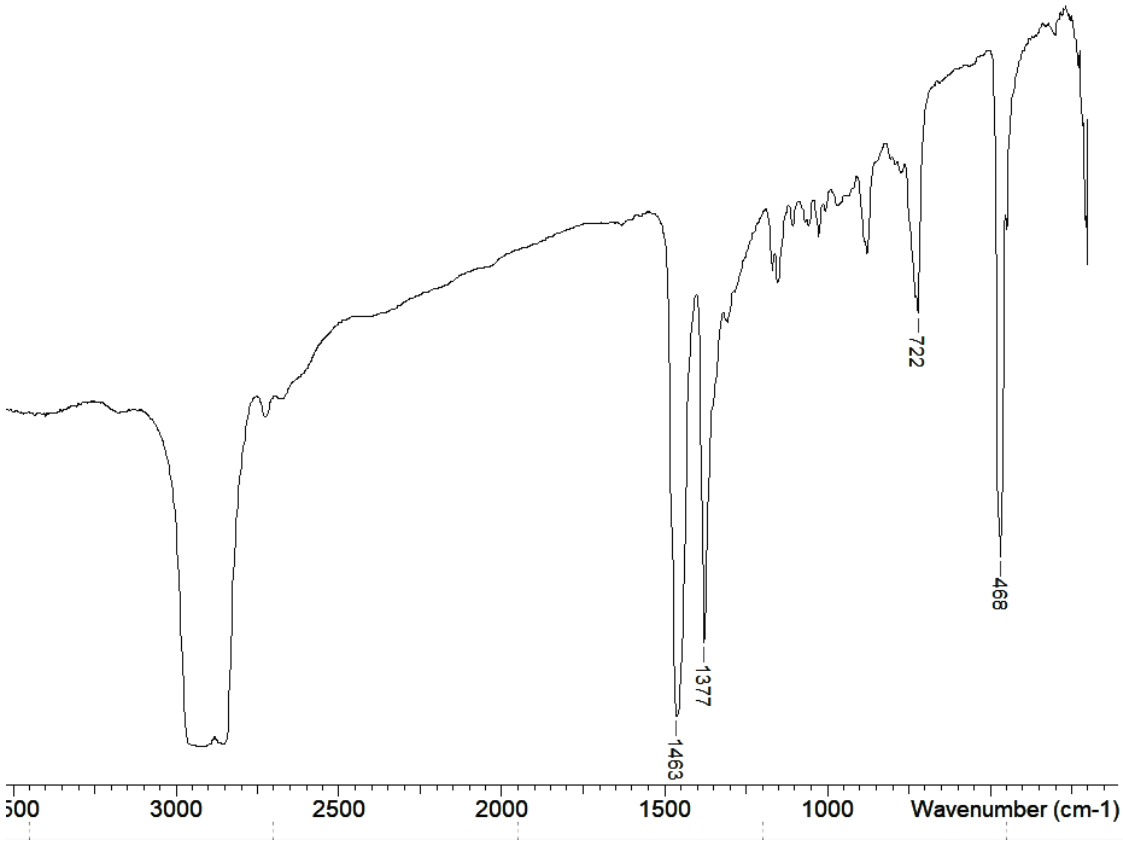


Figure S1: IR spectrum of $[N^nBu_4]_2[MoS_4]$.

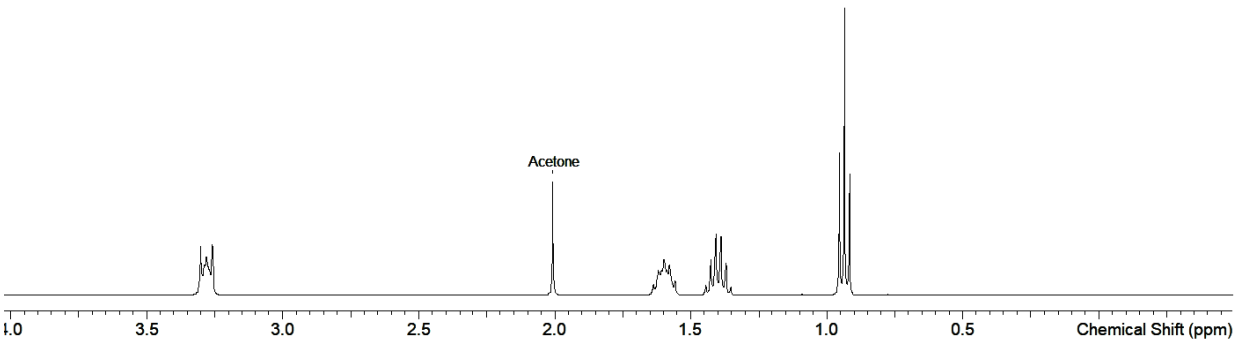


Figure S2: $^1H$ NMR spectrum of $[N^nBu_4]_2[MoS_4]$ in $CD_2Cl_2$.

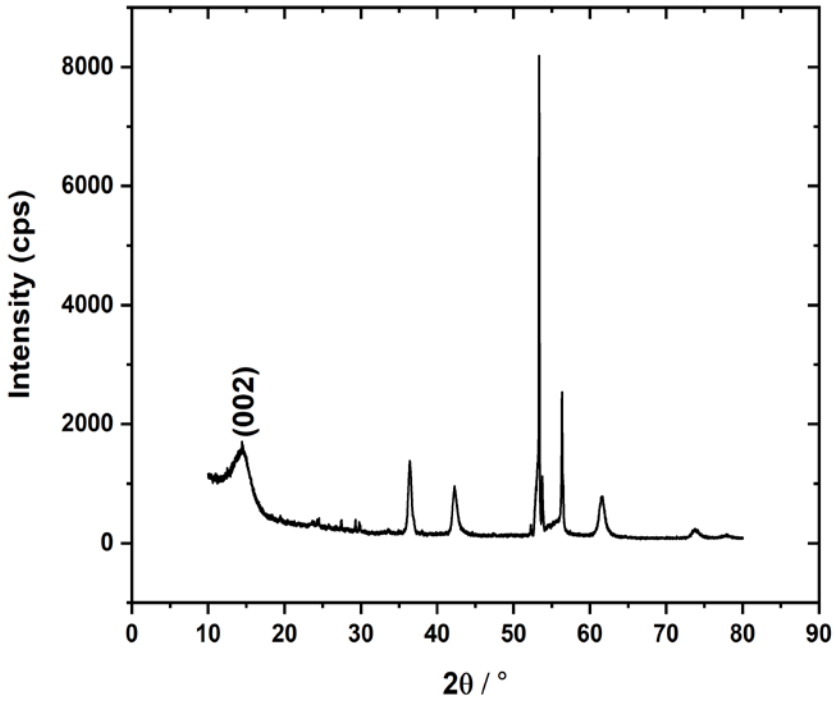


Figure S3: XRD pattern recorded from annealed $MoS_2$ thin film obtained by applying -0.8 V vs. Ag/AgCl for 1 hour.

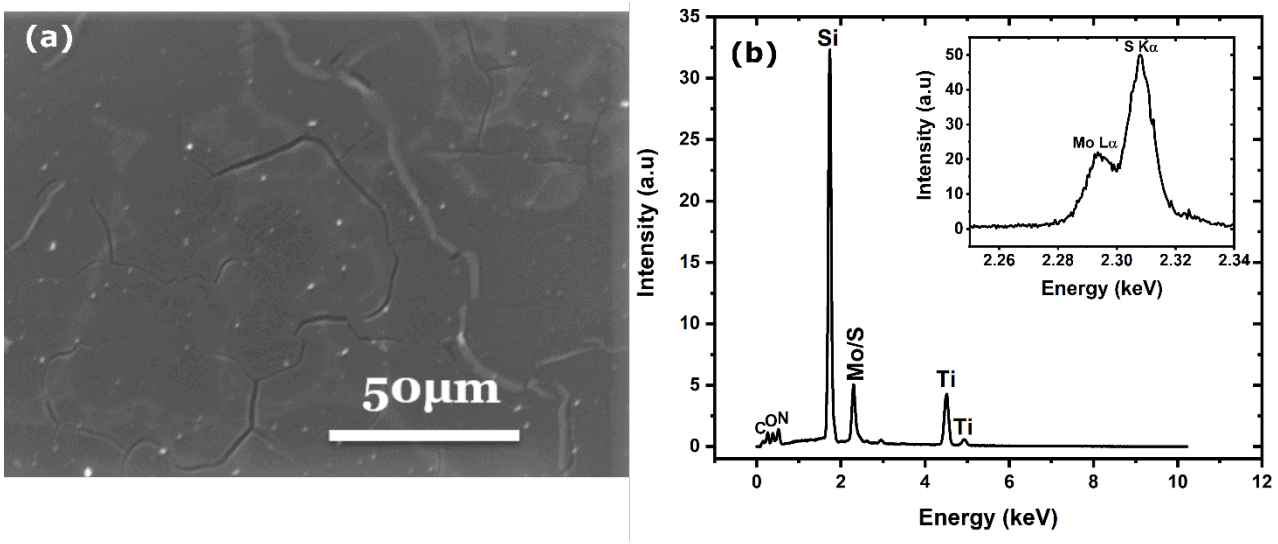


Figure S4: (a) Top-view SEM image of the as-deposited $MoS_2$ thin film obtained by applying -0.8 V vs. Ag/AgCl for 1 hour. (b) EDX profile of the as-deposited film. The inset shows the WDX spectrum for Mo-$L_\alpha$ and S-$K_\alpha$.

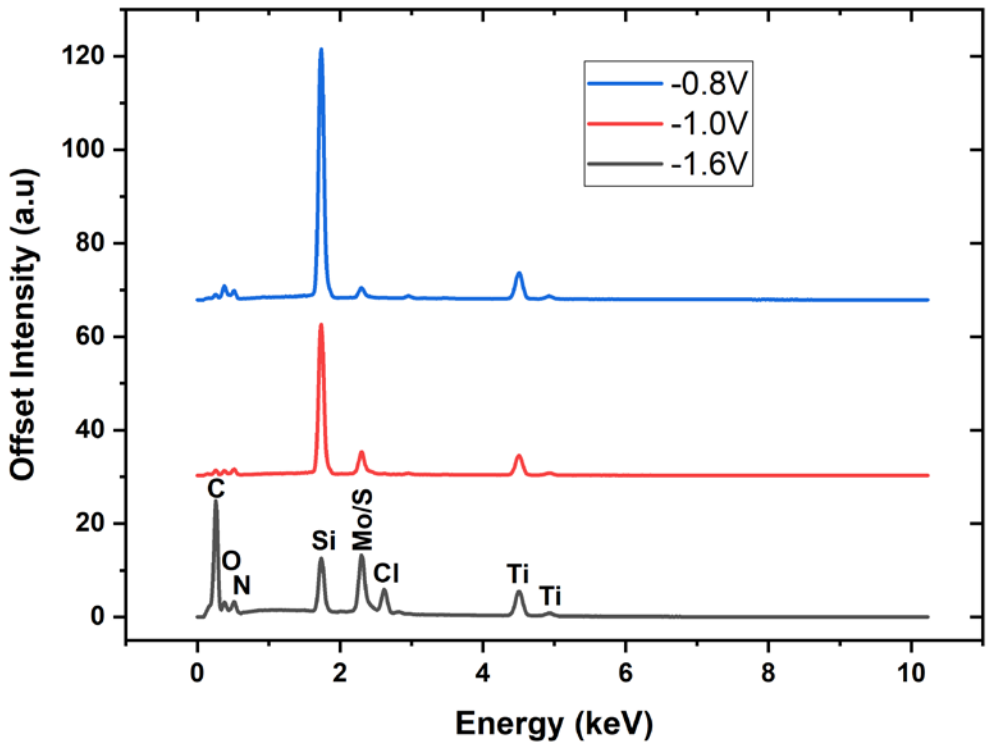


Figure S5: EDX profile of the as-deposited $MoS_2$ thin films obtained at different applied potentials vs. Ag/AgCl.

**References**

1. G. Alonso, G. Aguirre, I. A. Rivero, and S. Fuentes, *Inorg. Chim. Acta*, **274** (1), 108-110 (1998).