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**Liquid phase exfoliation of MoO$_2$ nanosheets for lithium ion battery applications**

John B. Boland,1,2 Andrew Harvey,1,2 Ruiyuan Tian,1,2 Damien Hanlon1,2 Victor Vega-Mayoral,1,2 Beata Szydlowska,1,2 Aideen Griffin,1,2 Tanja Stimpel-Lindner,3 Sonia Jaskaniec,1,4 Valeria Nicolosi,1,4 Georg Düsberg3 and Jonathan N. Coleman1,2*

1CRANN & AMBER Research Centers, Trinity College Dublin, Dublin 2, Ireland

2School of Physics, Trinity College Dublin, Dublin 2, Ireland


*colemaj@tcd.ie

![Figure 1: XPS analysis of MoO$_2$ films made by vacuum filtration. A shows the measured XPS spectrum of the sample and its fitted components. The sum of these fits is also shown for comparison with the observed spectrum. B indicates the variance of composition with sputtering depth.](image-url)
Figure 2: Centrifugation study of MoO$_3$ in CHP. A-C show the Extinction, Absorption and Scattering spectra respectively from UV-vis spectroscopic analysis.
Figure 3: Optimization of the exfoliation process. A-B show UV vis spectra for a study on variation in sonication time, where A and B are the extinction and absorption respectively. C Initial concentration study, D Solvent study.
Figure 4: AFM analysis of MoO$_2$ standard sample in IPA. A and B are representative AFM images. C is the step height analysis.
Figure 5: Flake size distribution of size selected samples from TEM analysis.

Figure 6: Representative TEM images from size selected samples.
Figure 7: X-ray diffraction spectra for bulk MoO$_2$ powder (black) as well as MoO$_2$ nanosheets cast into a film from a fresh dispersion (red) and MoO$_2$ nanosheets cast into a film from an aged dispersion (blue). The aged dispersion was stored in IPA for 2 months before testing. The magenta and navy arrows at the top represent the positions of the main lines for Mo$_4$O$_{11}$ and MoO$_3$ as reported by ref.$^1$. 
Figure 8: Comparison of weak peaks in fresh and aged nanosheet spectra. Weak MoO$_3$ and Mo$_4$O$_{11}$ peaks can be seen, predominately in the aged sample.

X-Ray diffraction (XRD) measurements were performed in a Bruker Advance Powder X-Ray diffractometer equipped with Cu-Ka emission source in Bragg-Brentano configuration. Bulk MoO$_2$ finely ground powder was directly deposited in a sample holder, while for the nanosheet dispersions, the measurements were done on thin films prepared on glass substrates.