

David Lewis  
Academic (Teaching & Research) Professor  
Materials Engineering



## Overview

I am the Head of the Department of Materials and Chair of Materials Chemistry. My research group investigates materials for energy generation in a broad sense, specifically targeting inorganic thin films and nanomaterials that are of use for a range of applications including thermoelectric, photocatalytic, electrocatalytic and photovoltaic power generation. To achieve this, we typically use materials chemistry to design low temperature bottom up syntheses utilising molecular precursors that allow exquisite control of the chemical composition of materials, thus allowing us to tailor them toward a specific application. We also use various top down processing techniques such as liquid phase exfoliation of layered crystals to produce thin inorganic semiconductors which are complementary to graphene. Recently we have pioneered the use of these processes in serial to produce new synthetic two-dimensional materials. In general, the use of solution phase pathways toward nanomaterials also allows us to take advantage of additive manufacturing processes, AACVD, spray coating and digital printing to assemble these inorganic materials into macroscopic structures and devices. The group collaborates internationally with a range of materials scientists, chemists, and physicists to achieve these goals.

### Exemplar publications by area

*Synthetic routes to complex metal chalcogenides and oxides (including high entropy materials and quantum dots)*

Ward O'Brien et al 'Quantum Confined High Entropy Lanthanide Oxysulfide Colloidal Nanocrystals' *Nano Lett.* 2022, 22, 8045–8051. DOI: 10.1021/acs.nanolett.2c01596

Ward O'Brien et al 'Synthesis of High Entropy Lanthanide Oxysulfides via the Thermolysis of a Molecular Precursor Cocktail' *J. Am. Chem. Soc.* 2021, 143, 21560–21566. DOI: 10.1021/jacs.1c08995

Alharbi, Y.T. et al 'Molecular Precursor route to Bourmonite Thin Films and Powders' *Inorg. Chem.* 2021, 60, 17, 13691–13698. DOI: 10.1021/acs.inorgchem.1c02001

Alsowayigh, M.; Timco, G.A.; Borilovic, I.; Alanazi, A.; Vitorica-Yrezabal, I. J.; Whitehead, G.F.S.; McNaughten, P.D.; Tuna, F.; O'Brien, P.; Wimpenny, R.E.P.; Lewis, D.J.\*; Collison D.\* 'Heterometallic 3d–4f Complexes as Air-Stable Molecular Precursors in Low Temperature Syntheses of Stoichiometric Rare-Earth Orthoferrite Powders' *Inorg. Chem.* 2020, 59, 15796–15806. DOI: 10.1021/acs.inorgchem.0c02249

Murtaza, G.; Alderhami, S.; Alharbi, Y. T.; Zulfikar, U.; Hossin, M.; Alanazi, A. M.; Almanqur, L.; Onche, E. U.; Venkateswaran, S.P.; Lewis, D. J.\* 'Scalable and Universal Route for the Deposition of Binary, Ternary, and Quaternary Metal Sulfide Materials from Molecular Precursors' *ACS Appl. Energy Mater.* 2020, 3, 1952–1961. DOI: 10.1021/acsaem.9b02359

Alanazi, A.M.; Alam, F.; Salhi, A.; Missous, M.; Thomas, A.G.; O'Brien, P.; Lewis, D.J.\* 'A molecular precursor route to quaternary chalcogenide CFTS (Cu<sub>2</sub>FeSnS<sub>4</sub>) powders as potential solar absorber materials' *RSC Adv.*, 2019, 9, 24146–24153. DOI: 10.1039/C9RA02926E.

Alqahtani, T.; Cernik, R.J.; O'Brien, P.; Lewis, D. J.\* 'Solid solutions of M<sub>2–2x</sub>In<sub>2x</sub>S<sub>3</sub> (M = Bi or Sb) by solventless thermolysis' *J. Mater. Chem. C*, 2019, 7, 5112–5121. DOI: 10.1039/C9TC00148D.

*Synthetic routes to layered and 2D materials beyond graphene:*

Zeng, N.; Wang, Y.-C.; Neilson, J.; Fairclough, S.; Zou, Y.; Thomas, A.G.; Cernik, R.J.; Haigh, S. J.; Lewis, D.J.\* 'Rapid and Low-Temperature Molecular Precursor Approach toward Ternary Layered Metal Chalcogenides and Oxides: Mo<sub>1–x</sub>W<sub>x</sub>S<sub>2</sub> and Mo<sub>1–x</sub>W<sub>x</sub>O<sub>3</sub> Alloys (0 ≤ x ≤ 1)' *Chem. Mater.* 2020, 32, 7895–7907. DOI: 10.1021/acs.chemmater.0c02685

Higgins, E.P.C.; McAdams, S.G.; Hopkinson, D.G.; Byrne, C.; Walton, A. S.; Lewis, D.J.\*; Dryfe, R.A.W.\* 'Room-Temperature Production of Nanocrystalline Molybdenum Disulfide (MoS<sub>2</sub>) at the Liquid–Liquid Interface' *Chem. Mater.* 2019, 31, 5384–5391. DOI: 10.1021/acs.chemmater.8b05232

Zeng, N.; Hopkinson, D.G.; Spencer, B.F.; McAdams, S.G.; Tedstone, A.A.; Haigh, S.J.; Lewis, D.J.\* 'Direct Synthesis of MoS<sub>2</sub> or MoO<sub>3</sub> via Thermolysis of a Dialkyl Dithiocarbamate Molybdenum(IV) Complex' *Chem. Commun.* 2019, 55, 99–102. DOI: 10.1039/C8CC08932A

Norton, K.; Kunstmann, J.\*; Ping, L.; Rakowski, A.; Wang, C.; Marsden, A.J.; Murtaza, G.; Zeng, N.; McAdams, S.; Ke J. C.-R.; Bissett, M.A.; Haigh, S.J.; Derby, B.; Seifert, G.; Lewis, D.J.\* 'Synthetic 2-D Lead Tin Sulfide Nanosheets With Tuneable Optoelectronic Properties From a Potentially Scalable Reaction Pathway' *Chem. Sci.* 2019, 10, 1035–1045. DOI: 10.1039/C8SC04018D

Brent, J. R. †; Lewis D. J.\*; Lorenz, T.; Lewis, E. A.; Savjani, N.; Haigh, S.J.; Seifert, G.\*; Derby, B.\*; O'Brien, P.\* 'Tin(II) Sulfide Nanosheets by Liquid-Phase Exfoliation of Herzenbergite: IV–VI Main Group Atomic Crystals' *J. Am. Chem. Soc.* 2015, DOI: 10.1021/jacs.5b08236

Brent, J. R.; Savjani, N.; Lewis, E. A.; Haigh, S. J.; Lewis, D. J.\*; O'Brien, P.\* 'Production of Few-Layer Phosphorene by Liquid Exfoliation of Black Phosphorus' *Chem. Commun.* 2014, 50, 13338–13341. DOI:10.1039/C4CC05752J

*Superhydrophobic nanomaterials:*

Zulfikar U. et al 'Flexible Nanoporous Activated Carbon for Adsorption of Organics from Industrial Effluents'

*Nanoscale* 2021, 13, 15311–15323. DOI:10.1039/D1NR03242A

Zulfiqar, U.; Thomas, A. G.; Yearsley, K.; Bolton L. W.; Matthews, A. \*; Lewis, D.J.\* 'Renewable Adsorbent for the Separation of Surfactant-Stabilized Oil in Water Emulsions Based on Nanostructured Sawdust' ACS Sustainable Chem. Eng. 2019, 7, 18935-18942 DOI: 10.1021/acssuschemeng.9b04294

Matthews, P.D.; Hirunpinyopas, W.; Lewis, E.A.; Brent, J.R.; McNaughton, P.D.; Zeng, N.; Thomas, A.G.; O'Brien, P.; Derby, B.; Bissett, M.A.; Haigh, S. J.; Dryfe, R.A.W.; Lewis, D.J.\* 'Black phosphorus with near-superhydrophobic properties and long-term stability in aqueous media' Chem. Commun. 2018, 54, 3831-3834. DOI: 10.1039/C8CC01789A

#### *Hybrid Perovskites:*

Alam, F.; Lewis, D.J.\* 'Thin films of formamidinium lead iodide (FAPbI<sub>3</sub>) deposited using aerosol assisted chemical vapour deposition (AACVD)' Sci. Rep. 2020, 10, 22245. DOI: 10.1038/s41598-020-79291-1

Mokhtar, M.; He, J.; Li, M.; Chen, Q.; Ke, J.C.R.; Lewis, D.J.; Thomas, A.G.; Spencer, B.F.; Haque, S.A.; Saunders, B.R. 'Bioinspired scaffolds that sequester lead ions in physically damaged high efficiency perovskite solar cells' Chem. Commun. 2021, DOI: 10.1039/D0CC02957B

Ke, J.C.-R.; Lewis, D.J.; Walton, A.S.; Spencer, B.F.; O'Brien, P.; Thomas, A.G.; Flavell, W.\* 'Ambient-air-stable inorganic Cs<sub>2</sub>SnI<sub>6</sub> double perovskite thin films via aerosol-assisted chemical vapour deposition' J. Mat. Chem. A 2018, 6, 11205-11214. DOI: 10.1039/C8TA03133A

Lewis, D. J.\*; O'Brien P.\* 'Ambient Pressure Aerosol-Assisted Chemical Vapour Deposition of (CH<sub>3</sub>NH<sub>3</sub>)PbBr<sub>3</sub>, an Inorganic-Organic Perovskite Important in Photovoltaics' Chem. Commun. 2014, 50, 6319-6321. DOI: 10.1039/C4CC02592J

## Qualifications

Master in Science, Chemistry (1st Class Hons. Birm), University of Birmingham

Award Date: 1 Dec 2006

Doctor of Philosophy

## Employment

[david.lewis-4@manchester.ac.uk](mailto:david.lewis-4@manchester.ac.uk)

Academic (Teaching & Research) Professor

Materials Engineering

The University of Manchester

1 Aug 2019 → present

### **Elected Member of the Materials Chemistry Division Council**

The Royal Society of Chemistry

London, United Kingdom

1 Jan 2022 → 1 Jan 2024

## Research output

### **Electronic transport and the thermoelectric properties of donor-doped SrTiO<sub>3</sub>**

Zhu, Y., Skelton, J. M., Lewis, D. J. & Freer, R., 18 Apr 2024, (E-pub ahead of print) In: Journal of Physics: Energy.

### **Effect of Graphene Oxide and Carbon Black on the Thermoelectric Performance of Niobium doped Strontium Titanate**

Zhu, Y., Ekren, D., Cao, J., Liu, X., Mudd, S. R., Boston, R., Xia, X., Li, Y., Kinloch, I. A., Lewis, D. J. & Freer, R., 15 Jun 2024, In: Journal of Alloys and Compounds. 988, 174242.

### **Ultra-low Thermal Conductivity in a Perovskite Oxide Thermoelectric through Entropy Engineering**

Zhu, Y., Liu, X., Buckingham, M. A., Acharyya, P., Guilmeau, E., Mehdi, B. L., Lewis, D. J. & Freer, R., 9 Feb 2024, (Accepted/In press) In: Journal of the European Ceramic Society.

### **Exceptional Thermoelectric Performance of Cu<sub>2</sub>(Zn,Fe,Cd)SnS<sub>4</sub> Thin Films**

Liu, Y., McNaughton, P., Liu, X., Kretinin, A., Skelton, J., Azough, F., Lewis, D. & Freer, R., 8 Feb 2024, (Accepted/In press) In: ACS Applied Materials and Interfaces .

**A combined experimental and modelling approach for the evaluation of the thermoelectric properties of Ag-doped SnS**  
Liu, Y., Skelton, J., Xia, X., Zhu, Y., Lewis, D. & Freer, R., 14 Jan 2024, In: Journal of Materials Chemistry C. 12, 2, p. 508-520 13 p.

**Enhancing the thermoelectric properties of TiO<sub>2</sub>-based ceramics through addition of carbon black and graphene oxide**  
Liu, X., Li, S., Yu, J., Zhu, Y., Lin, K., Wang, B., Cai, R., Ekren, D., Lewis, D., Kinloch, I., Reece, M. J. & Freer, R., 9 Oct 2023, (Accepted/In press) In: Carbon.

**Thermoelectric performance of tetrahedrite (Cu<sub>12</sub>Sb<sub>4</sub>S<sub>13</sub>) thin films: the influence of the substrate and interlayer**  
Liu, Y., Kretinin, A., Liu, X., Xiao, W., Lewis, D. & Freer, R., 11 Sept 2023, (Accepted/In press) In: ACS Applied Electronic Materials.

**Fabrication of High Quality Bornite and Chalcopyrite Thin Films by Aerosol Assisted Chemical Vapour Deposition**  
Barde, A. & Lewis, D. J., 22 Jun 2023, (Accepted/In press) In: The Journal of Physical Chemistry C.

**A Low-Temperature Synthetic Route Toward a High-Entropy 2D Hexernary Transition Metal Dichalcogenide for Hydrogen Evolution Electrocatalysis**  
Qu, J., Elgendy, A., Cai, R., Buckingham, M. A., Papaderakis, A. A., De Latour, H., Hazeldine, K., Whitehead, G. F. S., Alam, F., Smith, C. T., Binks, D. J., Walton, A., Skelton, J. M., Dryfe, R. A. W., Haigh, S. J. & Lewis, D. J., 17 May 2023, In: Advanced Science. 10, 14, 2204488.

**Enhanced Thermoelectric Performance of Tin(II) Sulfide Thin Films Prepared by Aerosol Assisted Chemical Vapor Deposition**  
Liu, Y., Mcnaughtner, P. D., Azough, F., Liu, X., Skelton, J. M., Kretinin, A. V., Lewis, D. J. & Freer, R., 24 Apr 2023, In: ACS Applied Energy Materials. 6, 8, p. 4462-4474

**Environment effects upon electrodeposition of thin film copper oxide nanomaterials**  
Buckingham, M., Xiao, W., Ward-O'Brien, B., Yearsley, K., Zulfiqar, U., Spencer, B., Matthews, A. & Lewis, D., 20 Mar 2023, In: Journal of Materials Chemistry C. 11, 14, p. 4876-4891 16 p.

**Precursor-Led Grain Boundary Engineering for Superior Thermoelectric Performance in Niobium Strontium Titanate**  
Zhu, Y., Azough, F., Liu, X., Zhong, X., Zhao, M., Margaronis, K., Kar-Narayan, S., Kinloch, I., Lewis, D. J. & Freer, R., 15 Mar 2023, In: ACS applied materials & interfaces. 15, 10, p. 13097-13107

**Spherical hydroxyapatite nanoparticle scaffolds for reduced lead release from damaged perovskite solar cells**  
Mokhtar, M. Z., Altujjar, A., Wang, B., Chen, Q., Ke, J. C., Cai, R., Zibouche, N., Spencer, B. F., Jacobs, J., Thomas, A. G., Hall, D., Haigh, S. J., Lewis, D. J., Curry, R., Islam, M. S. & Saunders, B. R., 1 Dec 2022, In: Communications Materials. 3, 1, 77.

**Quantum Confined High Entropy Lanthanide Oxysulfide Colloidal Nanocrystals**  
Ward-O'Brien, B., Mcnaughtner, P., Cai, R., Chattopadhyay, A., Flitcroft, J., Smith, C., Binks, D., Skelton, J., Haigh, S. & Lewis, D., 26 Oct 2022, In: Nano Letters. p. 8045-8051

**Tunable structural and optical properties of Ag<sub>x</sub>Cu<sub>y</sub>InS<sub>2</sub> colloidal quantum dots**  
Ming, S., Taylor, R. A., Mcnaughtner, P. D., Lewis, D. J. & O'Brien, P., 23 Sept 2022, In: New Journal of Chemistry. 46, p. 18899-18910

**High Entropy Metal Chalcogenides: Synthesis, Properties, Applications and Future Directions**  
Buckingham, M. A., Ward-O'Brien, B., Xiao, W., Li, Y., Qu, J. & Lewis, D. J., 23 Jun 2022, In: Chemical Communications. 58, p. 8025-8037

**Investigating the effect of steric hindrance within CdS single-source precursors on the material properties of AACVD and spin coat-deposited CdS thin films**  
Buckingham, M., Norton, K., Mcnaughtner, P., Whitehead, G., Vitorica-Yrezabal, I., Alam, F., Laws, K. & Lewis, D., 30 May 2022, In: Inorganic Chemistry. 61, 21, p. 8206-8216

**Tunable structural, morphological and optical properties of undoped, Mn, Ni and Ag-doped CuInS<sub>2</sub> thin films prepared by AACVD**

Ming, S., Taylor, R. A., O'Brien, P., Mcnaughtner, P. D. & Lewis, D. J., 1 Jan 2022, In: Materials science in semiconductor processing. 137, p. 106224 106224.

**Synthesis of High Entropy Lanthanide Oxysulfides via the Thermolysis of a Molecular Precursor Cocktail**

Ward-O'Brien, B., Pickering, E. J., Ahumada Lazo, R., Smith, C., Zhong, X., Aboura, Y., Alam, F., Binks, D., Burnett, T. & Lewis, D. J., 18 Dec 2021, In: Journal of the American Chemical Society.

**Sustainable ITO films with reduced indium content deposited by AACVD**

Ma, T., Missous, M., Pinter, G., Zhong, X., Spencer, B., Thomas, A. G. & Lewis, D. J., 7 Dec 2021, In: Journal of Materials Chemistry C. 10, 579-589.

**Nanoscale Chevrel Phase Mo<sub>6</sub>S<sub>8</sub> Prepared by a Molecular Precursor Approach for Highly Efficient Electrocatalysis of the Hydrogen Evolution Reaction in Acidic Media**

Elgendy, A., Papaderakis, A., Byrne, C., Sun, Z., Lauritsen, J. V., Higgins, E. P. C., Ejigu, A., Cernik, R., Walton, A., Lewis, D. & Dryfe, R., 22 Nov 2021, In: ACS Applied Energy Materials. 4, 11, 13015–13026.

**Structural investigations of  $\alpha$ -MnS nanocrystals and thin films synthesised from manganese(II) xanthates by hot injection, solvent-less thermolysis and doctor blade routes.**

Alanazi, A., Mcnaughtner, P., Alam, F., Vitorica-Yrezabal, I., Whitehead, G., Tuna, F., O'Brien, P., Collison, D. & Lewis, D., 26 Oct 2021, In: ACS Omega. 6, 42, p. 27716–27725

**Heavy metal pollution and the role of inorganic nanomaterials in environmental remediation**

Mensah, M. B., Lewis, D., Boadi, N. O. & Awudza, J. A. M., 13 Oct 2021, In: Royal Society Open Science. 8, 10

**High Performance Nanostructured MoS<sub>2</sub> Electrodes with Spontaneous Ultra-Low Gold Loading for Hydrogen Evolution**

Higgins, E., Papaderakis, A., Byrne, C., Cai, R., Haigh, S., Ahmed Sadek, A., Walton, A., Lewis, D. & Dryfe, R., 30 Sept 2021, In: The Journal of Physical Chemistry Part C: Nanomaterials, Interfaces and Hard Matter. 125, 38, p. 20940-20951 12 p.

**Flexible nanoporous activated carbon for adsorption of organics from industrial effluents**

Zulfiqar, U., Kostoglou, N., Thomas, A., Rebholz, C., Matthews, A. & Lewis, D., 28 Sept 2021, In: Nanoscale. 13, 36, p. 15311-15323 13 p.

**Molecular Precursor Route to Bournonite (CuPbSbS<sub>3</sub>) Thin Films and Powders**

Alharbi, Y. T., Alam, F., Parvez, K., Missous, M. & Lewis, D. J., 6 Sept 2021, In: Inorganic Chemistry. 60, 17, p. 13691-13698 8 p.

**Preparation of solution processed photodetectors comprised of two-dimensional tin(II) sulfide nanosheet thin films assembled via the Langmuir–Blodgett method**

Norton, K., Jacobs, J., Neilson, J., Hopkinson, D., Mokhtar, M. Z., Curry, R. J. & Lewis, D. J., 6 Aug 2021, In: RSC Advances. 11, 43, p. 26813-26819 7 p.

**Testing the Efficacy of the Synthesis of Iron Antimony Sulfide powders from Single Source Precursors**

Makin, F., Alzahrani, D., Alam, F., Tuna, F. & Lewis, D., 2 Aug 2021, In: Inorganics. 9, 8, 61.

**Intrinsic Effects of Thickness, Surface Chemistry and Electroactive Area on Nanostructured MoS<sub>2</sub> Electrodes with Superior Stability for Hydrogen Evolution**

Higgins, E., Papaderakis, A., Byrne, C., Walton, A., Lewis, D. & Dryfe, R., 20 Jun 2021, In: Electrochimica Acta. 382, 138257.

**Tunable Structural and Optical Properties of CuInS<sub>2</sub> Colloidal Quantum Dots as Photovoltaic Absorbers**

Ming, S-K., Taylor, R. A., Mcnaughtner, P., Lewis, D., Leontiadou, M. & O'Brien, P., 16 Jun 2021, In: RSC Advances. 11, p. 21351-21358

**Synthesis, X-ray single-crystal structural characterization and thermal analysis of bis(O-alkylxanthato)Cd(II) and bis(O-alkylxanthato)Zn(II) complexes used as precursors for cadmium and zinc sulfide thin films**

Bakly, A., Collison, D., Ahumada Lazo, R., Binks, D., Smith, M., Raftery, J., Whitehead, G. F. S., O'Brien, P. & Lewis, D., 17 May 2021, In: *Inorganic Chemistry*. 60, 10, 7573–7583.

**Direct Synthesis of Nanostructured Silver Antimony Sulfide Powders from Metal Xanthate Precursors**

Alharbi, Y., Alam, F., Salhi, A., Missous, M. & Lewis, D., 4 Feb 2021, In: *Scientific Reports*.

**Synthesis of molybdenum-doped rhenium disulfide alloy using aerosol-assisted chemical vapour deposition**

Al-dulaimi, N., Al-shakban, M., Lewis, E. A., Mcnaughten, P. D., Alam, F., Haigh, S. J. & Lewis, D. J., 2 Feb 2021, In: *Materials science in semiconductor processing*. 127, p. 105718

**A Review of the Synthesis, Properties, and Applications of Bulk and Two-Dimensional Tin(II) Sulfide (SnS)**

Norton, K., Alam, F. & Lewis, D., 2021, In: *Applied Sciences*. 11, 5, p. 2062 2062.

**Bioinspired scaffolds that sequester lead ions in physically damaged high efficiency perovskite solar cells**

Mokhtar, M. Z., He, J., Li, M., Chen, Q., Ke, J. C. R., Lewis, D. J., Thomas, A. G., Spencer, B. F., Haque, S. A. & Saunders, B. R., 22 Dec 2020, (E-pub ahead of print) In: *Chemical Communications*.

**Heterometallic 3d-4f complexes as air-stable molecular pre-cursors in low temperature syntheses of stoichiometric rare-earth orthoferrite powders**

Alsowayigh, M. M., Timco, G., Borilovic, I., Alanazi, A., Vitorica-Yrezabal, I., Whitehead, G., Mcnaughten, P., Tuna, F., O'Brien, P., Winpenny, R., Lewis, D. & Collison, D., 2 Nov 2020, In: *Inorganic Chemistry*. 59, 21, p. 15796–15806 11 p.

**A Rapid and Low Temperature Molecular Precursor Approach Toward Ternary Layered Metal Chalcogenides and Oxides: Mo<sub>1-x</sub>W<sub>x</sub>S<sub>2</sub> and Mo<sub>1-x</sub>W<sub>x</sub>O<sub>3</sub> alloys (0 ≤ x ≤ 1).**

Zeng, N., Wang, Y-C., Neilson, J., Fairclough, S., Zou, Y., Thomas, A., Cernik, R., Haigh, S. & Lewis, D., 22 Sept 2020, *Chemistry of Materials*.

**Synthesis of Indium Oxide Microparticles using Aerosol Assisted Chemical Vapour Deposition**

Alam, F. & Lewis, D., 3 Jun 2020, (Accepted/In press) In: *RSC Advances*.

**PAUL O'BRIEN: 22nd January 1954 – 16th October 2018**

Lewis, D. & Winpenny, R., 20 May 2020, (Accepted/In press) In: *Royal Society of London. Biographical Memoirs of Fellows of the Royal Society*.

**A molecular precursor route to quaternary chalcogenide CFTS (Cu<sub>2</sub>FeSnS<sub>4</sub>) powders as potential solar absorber materials**

Alanazi, A., Alam, F., Salhi, A., Missous, M., Thomas, A., O'Brien, P. & Lewis, D., 5 Aug 2019, In: *RSC Advances*.

**Formation and Healing of Defects in Atomically Thin GaSe and InSe**

Hopkinson, D. G., Zólyomi, V., Rooney, A. P., Clark, N., Terry, D. J., Hamer, M., Lewis, D. J., Allen, C. S., Kirkland, A. I., Andreev, Y., Kudrynskiy, Z., Kovalyuk, Z., Patané, A., Fal'ko, V. I., Gorbachev, R. & Haigh, S. J., 4 Apr 2019, In: *ACS Nano*. 13, 5, p. 5112–5123

**Chemical vapor deposition of tin sulfide from diorganotin(IV) dixanthates**

Al-shakban, M., Matthews, P. D., Lewis, E. A., Raftery, J., Vitorica-yrezabal, I., Haigh, S. J., Lewis, D. J. & O'brien, P., Feb 2019, In: *Journal of Materials Science*. 54, 3, p. 23315-2323

**Synthetic 2-D Lead Tin Sulfide Nanosheets with Tuneable Optoelectronic Properties from a Potentially Scalable Reaction Pathway**

Norton, K., Kunstmann, J., Ping, L., Rakowski, A., Wang, C., Marsden, A. J., Murtaza, G., Zeng, N., McAdams, S. J., Bissett, M. A., Haigh, S. J., Derby, B., Seifert, G. & Lewis, D. J., 1 Jan 2019, In: *Chemical Science*. 10, 4, p. 1035-1045 11 p.

**Accessing  $\gamma$ -Ga<sub>2</sub>S<sub>3</sub> by solventless thermolysis of gallium xanthates: A low temperature limit for crystalline products?**  
Alderhami, S., McNaughter, P., Spencer, B., Vitorica-Yrezabal, I., Whitehead, G., O'Brien, P. & Lewis, D., 2019, In: Dalton Transactions.

**Air-Stable Methylammonium Lead Iodide Perovskite Thin Films Fabricated via Aerosol-Assisted Chemical Vapor Deposition from a Pseudohalide Pb(SCN)<sub>2</sub> Precursor**

Ke, J. C-R., Lewis, D., Walton, A., Chen, Q., Spencer, B., Mokhtar, M. Z., Compean Gonzalez, C. L., O'Brien, P., Thomas, A. & Flavell, W., 2019, In: ACS Applied Energy Materials.

**Renewable Adsorbent for the Separation of Surfactant-Stabilized Oil in Water Emulsions Based on Nanostructured Sawdust**

Zulfiqar, U., Thomas, A. G., Yearsley, K., Bolton, L. W., Matthews, A. & Lewis, D. J., 2019, In: ACS Sustainable Chemistry & Engineering.

**Room Temperature Production of Nanocrystalline Molybdenum Disulfide (MoS<sub>2</sub>) at the Liquid-Liquid Interface**

Higgins, E. P. C., McAdams, S. G., Hopkinson, D. G., Byrne, C., Walton, A. S., Lewis, D. J. & Dryfe, R. A. W., 2019, In: Chemistry of Materials.

**Solid solutions of M<sub>2</sub>-2xIn<sub>2</sub>S<sub>3</sub> (M = Bi or Sb) by Solventless Thermolysis**

Alqahtani, T., Cernik, R. J., O'Brien, P. & Lewis, D. J., 2019, In: Journal of Materials Chemistry C.

**Synthesis of Iron Sulfide Thin Films and Powders from New Xanthate Precursors**

Almanqur, L., Alam, F., Whitehead, G., Vitorica-yrezabal, I., O'Brien, P. & Lewis, D. J., 2019, In: Journal of Crystal Growth

**Ricinoleic Acid as a Green Alternative to Oleic Acid in the Synthesis of Doped Nanocrystals**

Mensah, M. B., McNaughter, P. D., McAdams, S. G., Tuna, F., Lewis, D. J., Awudza, J. A. M., Revaprasadu, N. & O'Brien, P., Dec 2018, In: ChemistrySelect. 3, 48, p. 13548-13552 5 p.

**Decoupling Structure and Composition of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3-x</sub>Br<sub>x</sub> Films Prepared by Combined One-Step and Two-Step Deposition**

Mokhtar, M. Z., Chen, Q., Lian, Q., Lewis, D. J., Saunders, B. R., Walton, A. S., Ke, C., Whittaker, E., Hamilton, B. & Haque, S., 22 Oct 2018, In: ACS Applied Energy Materials. 1, 10, p. 5567-5578 11 p.

**Ambient-Air-Stable Inorganic Cs<sub>2</sub>SnI<sub>6</sub> Double Perovskite Thin Films via Aerosol-Assisted Chemical Vapour Deposition**

Ke, J. C-R., Lewis, D., Walton, A., Spencer, B., O'Brien, P., Thomas, A. & Flavell, W., 10 May 2018, In: Journal of Materials Chemistry A. 6, 24, p. 11205-11214 10 p.

**Fully printed high performance humidity sensors based on two-dimensional materials**

He, P., Brent, J., Ding, H., Yang, J., Lewis, D., O'Brien, P. & Derby, B., 15 Feb 2018, In: Nanoscale. 10, 12, p. 5599-5606 8 p.

**Black Phosphorus with Near-Superhydrophobic Properties and Long-Term Stability in Aqueous Media**

Matthews, P. D., Hirunpinyopas, W., Lewis, E. A., Brent, J. R., McNaughter, P. D., Zeng, N., Thomas, A. G., O'Brien, P., Derby, B., Bissett, M. A., Haigh, S. J., Dryfe, R. A. W. & Lewis, D. J., 2018, In: Chemical Communications.

**Chemical vapour deposition of chromium-doped tungsten disulphide thin films on glass and steel substrates from molecular precursors**

Murtaza, G., Venkateswaran, S. P., Thomas, A. G., O'Brien, P. & Lewis, D. J., 2018, In: Journal of Materials Chemistry C. 6, 35, p. 9537-9544 8 p.

**Direct Synthesis of MoS<sub>2</sub> or MoO<sub>3</sub> via Thermolysis of a Dialkyl Dithiocarbamate Molybdenum(IV) Complex**

Zeng, N., Hopkinson, D. G., Spencer, B., McAdams, S., Tedstone, A., Haigh, S. J. & Lewis, D. J., 2018, In: Chemical Communications.

**Exploiting Inherent Instability of 2D Black Phosphorus for Controlled Phosphate Release from Blow-Spun Poly (lactide-co-glycolide) Nanofibers**

Kamyar, N., Greenhalgh, R. D., Nascimento, T. R. L., Medeiros, E. S., Matthews, P. D., Nogueira, L. P., Haugen, H. J., Lewis, D. & Blaker, J., 2018, In: ACS Applied Nano Materials. 1, 8

**Full compositional control of  $PbS_xSe_{1-x}$  thin films by use of acylchalcogourato lead(II) complexes as precursors for AACVD**

Ezenwa, E., Mcnaughtner, P., Raftery, J., Lewis, D. & O'Brien, P., 2018, In: Dalton Transactions. 47, p. 16938-16943 5 p.

**On the Phase Control of  $CuInS_2$  Nanoparticles from Cu-/In-Xanthates**

Al-Shakban, M., Matthews, P. D., Zhong, X. L., Vitorica-Yrezabal, I., Raftery, J., Lewis, D. & O'Brien, P., 2018, In: Dalton Transactions.

**Synthesis of  $Bi_{2-2x}Sb_{2x}S_3$  ( $0 \leq x \leq 1$ ) solid solutions from solventless thermolysis of metal xanthate precursors**

Alqahtani, T., Khan, M. D., Kelly, D. J., Haigh, S. J., Lewis, D. J. & O'Brien, P., 2018, In: Journal of Materials Chemistry C. 6, 46, p. 12652-12659 8 p.

**Synthesis of Nanostructured Powders and Thin Films of Iron Sulfide from Molecular Precursors**

Almanqur, L., Vitorica-Yrezabal, I., Whitehead, G., Lewis, D. & O'Brien, P., 2018, In: RSC Advances.

**Dual Functionalization of Liquid-Exfoliated Semiconducting 2H-MoS<sub>2</sub> with Lanthanide Complexes Bearing Magnetic and Luminescence Properties**

Mcadams, S., Lewis, E. A., Brent, J. R., Haigh, S., Thomas, A., O'Brien, P., Tuna, F. & Lewis, D., 8 Nov 2017, In: Advanced Functional Materials. 27, 42, 1703646.

**The influence of precursor on rhenium incorporation into Re-doped MoS<sub>2</sub> ( $Mo_{1-x}Re_xS_2$ ) thin films by aerosol-assisted chemical vapour deposition (AACVD)**

Al-Dulaimi, N., Lewis, E., Savjani, N., Mcnaughtner, P., Haigh, S., Malik, M., Lewis, D. & O'Brien, P., 23 Aug 2017, In: Journal of Materials Chemistry C. 5, 35, p. 9044-9052 9 p.

**A Review of Two-Dimensional Nanomaterials Beyond Graphene**

Tedstone, A. A., Brent, J. R. & Lewis, D., 16 Aug 2017, *Specialist Periodical Reports: Nanoscience Volume 4*. Royal Society of Chemistry

**A Free-standing and Self-healable Two-dimensional Supramolecular Material Based on Hydrogen Bonding: A Nano-wire Array with Sub-2 nm Resolution**

Li, M., Song, M., Wu, G., Tang, Z., Sun, Y., He, Y., Li, J., Li, L., Gu, H., Liu, X., Ma, C., Peng, Z., Ai, Z. & Lewis, D., 6 Jun 2017, In: Small. 13, 21, 1604077.

**A Single Source Precursor for Tungsten Dichalcogenide Thin Films:  $Mo_{1-x}W_xS_2$  ( $0 \leq x \leq 1$ ) Alloys by Aerosol-Assisted Chemical Vapor Deposition (AACVD)**

Tedstone, A., Lewis, E., Savjani, N., Zhong, X. L., Haigh, S., O'Brien, P. & Lewis, D., 9 May 2017, In: Chemistry of Materials. 29, 9, p. 3858-3862 5 p.

**In situ investigation of degradation at organometal halide perovskite surfaces by X-ray photoelectron spectroscopy at realistic water vapour pressure**

Ke, C-R., Walton, A., Lewis, D., Tedstone, A., O'Brien, P., Thomas, A. & Flavell, W., 19 Apr 2017, In: Chemical Communications. 53, p. 5231-5234

**Exploring the versatility of liquid phase exfoliation: Producing 2D nanosheets from talcum powder, cat litter and beach sand**

Harvey, A., Boland, J. B., Godwin, I., Kelly, A. G., Szydłowska, B. M., Murtaza, G., Thomas, A., Lewis, D., O'Brien, P. & Coleman, J. N., 24 Mar 2017, In: 2 D Materials. 4, 2, 025054.

**Formation and Characterization of Model Iron Sulfide Scales with Disulfides and Thiols on Steel Pipeline Materials by an Aerosol Assisted Chemical Vapor Method**

Murtaza, G., Nowicka-Dylag, C., Tedstone, A., Orwig, S., West, K. R., Warrens, C. P., Venkateswaran, S. P., Gaemers, S., Wei, M., Thomas, A., O'Brien, P. & Lewis, D., 2017, In: Energy & Fuels .

**High magnetic relaxivity in a fluorescent CdSe/CdS/ZnS quantum dot functionalized with MRI contrast molecules**

McAdams, S., Lewis, D., McNaughten, P., Lewis, E., Haigh, S., O'Brien, P. & Tuna, F., 2017, In: Chemical Communications.

**Property Self-Optimization During Wear of MoS<sub>2</sub>**

Hao, R., Tedstone, A., Lewis, D., Warrens, C. P., West, K. R., Howard, P., Gaemers, S., Dillon, S. J. & O'Brien, P., 2017, In: ACS Applied Materials and Interfaces. 9, 2, p. 1953–1958

**Shining a Light on Transition Metal Chalcogenides for Sustainable Photovoltaics**

Matthews, P. D., McNaughten, P., Lewis, D. & O'Brien, P., 2017, In: Chemical Science.

**Solution Processing of Two-Dimensional Black Phosphorus**

Lewis, E., Brent, J., Derby, B., Haigh, S. & Lewis, D., 2017, In: Chemical Communications. 53

**Tailoring iridium luminescence and gold nanoparticle size for imaging of microvascular blood flow**

Rogers, N. J., Jeffrey, H., Claire, S., Lewis, D., Zikeli, G., Hodges, N., Egginton, S., Nash, G. B. & Pikramenou, Z., 2017, In: nanomedicine. 12, 22

**Nanostructured aptamer-functionalized black phosphorus sensing platform for label-free detection of myoglobin, a cardiovascular disease biomarker**

Kumar, V., Brent, J. R., Shorie, M., Kaur, H., Chadha, G., Thomas, A. G., Lewis, E. A., Rooney, A. P., Nguyen, L., Zhong, X. L., Burke, M. G., Haigh, S. J., Walton, A., McNaughten, P. D., Tedstone, A. A., Savjani, N., Muryn, C. A., O'Brien, P., Ganguli, A. K., Lewis, D. J., & 1 others Sabherwal, P., 7 Sept 2016, In: ACS Applied Materials and Interfaces. 8, 35, p. 22860–22868 9 p.

**Diatom Frustules as a Biomineralised Scaffold for the Growth of Molybdenum Disulfide Nanosheets**

Lewis, E., Lewis, D., Tedstone, A., Kime, G., Hammersley, S., Dawson, P., Binks, D., O'Brien, P. & Haigh, S., 2 Aug 2016 , In: Chemistry of Materials. 28, 16, p. 5582–5586

**Sequential bottom-up and top-down processing for the synthesis of transition metal dichalcogenide nanosheets: the case of rhenium disulfide (ReS<sub>2</sub>)**

Al-Dulaimi, N., Lewis, E., Lewis, D., Howell, S., Haigh, S. & O'Brien, P., 20 May 2016, In: Chemical Communications. 52, p. 7878 7881 p.

**Synthesis, Properties, and Applications of Transition Metal-Doped Layered Transition Metal Dichalcogenides**

Tedstone, A. A., Lewis, D. J. & O'Brien, P., Apr 2016, In: Chemistry of Materials. 28, 7, p. 1965–1974

**Chemical Vapour Deposition of Rhenium Disulfide and Rhenium-Doped Molybdenum Disulfide Thin Films Using Single-Source Precursors**

Al-Dulaimi, N., Lewis, D. J., Zhong, X. L., Malik, M. & O'Brien, P., Feb 2016, In: Journal of Materials Chemistry C. 4, p. 2312-2318 7 p.

**Biological Applications of Nanomaterials**

Rogers, N. & Lewis, D., 7 Jan 2016, *Nanoscience*. Royal Society of Chemistry, Vol. 3.

**Heterocyclic dithiocarbamate-iron(III) complexes: single-source precursors for aerosol-assisted chemical vapour deposition (AACVD) of iron sulfide thin films**

Mlowe, S., Lewis, D. J., Malik, M. A., Raftery, J., Mubofu, E. B., O'Brien, P. & Revaprasadu, N., 2016, In: Dalton Transactions. 45, p. 2647-2655



**On the Stability of Surfactant-Stabilised Few-Layer Black Phosphorus in Aqueous Media**

Brent, J. R., Ganguli, A. K., Kumar, V., Lewis, D., Mcnaughtner, P., O'Brien, P., Sabherwal, P. & Tedstone, A., 2016, In: RSC Advances. 6, 90, p. 86955-86958

**Morphology and band gap controlled AACVD of CdSe and CdS<sub>x</sub>Se<sub>1-x</sub> thin films using novel single source precursors: Bis(diethylidithio/diselenocarbamate)cadmium(II)**

Kevin, P., Alghamdi, Y. G., Lewis, D. J. & Malik, A., Dec 2015, In: Materials science in semiconductor processing. 40, p. 848-854 7 p.

**Transition Metal Doped Pyrite (FeS<sub>2</sub>) Thin Films: Structural Properties and Evaluation of Optical Band Gap Energies**

Khalid, S., Malik, M., Lewis, D., Kevin, P., Ahmed, E., Khan, Y. & O'Brien, P., 30 Oct 2015, In: Journal of Materials Chemistry C. 3, p. 12068-12076

**Tin(II) Sulfide (SnS) Nanosheets by Liquid-Phase Exfoliation of Herzenbergite: IV-VI Main Group Two-Dimensional Atomic Crystals**

Brent, J. R., Lewis, D. J., Lorenz, T., Lewis, E. A., Savjani, N., Haigh, S. J., Seifert, G., Derby, B. & O'Brien, P., 9 Sept 2015, In: Journal of the American Chemical Society. 137, 39, p. 12689-12696 8 p.

**Thin Films of Molybdenum Disulfide Doped with Chromium by Aerosol-Assisted Chemical Vapor Deposition (AACVD)**

Lewis, D., Tedstone, A., Zhong, X. L., Lewis, E., Rooney, A., Savjani, N., Brent, J., Haigh, S. J., Burke, M. G., Muryn, C., Raftery, J., Warrens, C., West, K., Gaemers, S. & O'Brien, P., 31 Jan 2015, In: Chemistry of Materials. 27, 4, p. 1367-1374 8 p.

**Synthesis of pyrite thin films and transition metal doped pyrite thin films by aerosol-assisted chemical vapour deposition**

Khalid, S., Ahmed, E., Malik, M. A., Lewis, D., Abu Bakar, S., Khan, Y. & O'Brien, P., 2015, In: New Journal of Chemistry. 39, 2, p. 1013-1021 9 p.

**Bis(piperidinedithiocarbamate)pyridinecadmium(II) as a single-source precursor for the synthesis of CdS nanoparticles and aerosol-assisted chemical vapour deposition (AACVD) of CdS thin films**

Mlowe, S., Lewis, D., Malik, M. A., Raftery, J., Mubofu, E. B., O'Brien, P. & Revaprasadu, N., 18 Sept 2014, In: New Journal of Chemistry. 38, 12, p. 6073-6080 8 p.

**Production of few-layer phosphorene by liquid exfoliation of black phosphorus**

Brent, J. R., Savjani, N., Lewis, E. A., Haigh, S. J., Lewis, D. J. & O'Brien, P., 8 Sept 2014, In: Chemical Communications. 50, 87, p. 13338-13341 4 p.

**Routes to tin chalcogenide materials as thin films or nanoparticles: a potentially important class of semiconductor for sustainable solar energy conversion**

Lewis, D., Kevin, P., Bakr, O., Muryn, C., Malik, M. & O'Brien, P., 5 Aug 2014, In: Inorganic Chemistry Frontiers. 1, 8, p. 577-598 22 p.

**Thin films of tin(II) sulphide (SnS) by aerosol-assisted chemical vapour deposition (AACVD) using tin(II) dithiocarbamates as single-source precursors**

Kevin, P., Lewis, D., A. Malik, M., Raftery, J., Malik, M. A. & O'Brien, P., 17 Jul 2014, In: JOURNAL OF CRYSTAL GROWTH. 415, p. 93-99 7 p.

**Ambient pressure aerosol-assisted chemical vapour deposition of (CH<sub>3</sub>NH<sub>3</sub>)PbBr<sub>3</sub>, an inorganic-organic perovskite important in photovoltaics**

Lewis, D. & O'Brien, P., 2014, In: Chemical Communications. 50, 48, p. 6319-6321 3 p.

**De Novo Design of Ln (III) Coiled Coils for Imaging Applications**

Berwick, M., Lewis, D., Jones, A., Parslow, R., Dafforn, T. R., Cooper, H. J., Wilkie, J., Pikramenou, Z., Britton, M. & Peacock, A. F. A., 2014, In: Journal of the American Chemical Society. 136, 4, p. 1166-1169

#### **Lanthanide-coated gold nanoparticles for biomedical applications**

Lewis, D. & Pikramenou, Z., 2014, In: Coordination Chemistry Reviews. 273-274, p. 213-225

#### **Luminescent gold surfaces for sensing and imaging: p: alternating of transition metal probes**

Adams, S., Lewis, D., Preece, J. & Pikramenou, Z., 2014, In: ACS Applied Materials and Interfaces. 6, 14, p. 11598-11608

#### **On the interaction of copper(II) with disulfiram**

Lewis, D. J., Deshmukh, P., Tedstone, A., Tuna, F. & O'Brien, P., 2014, In: Chemical Communications. 50, 87, p. 13334-13337 4 p.

#### **Silica nanoparticles for micro-particle imaging velocimetry: complexes: Fluorosurfactant improves nanoparticle stability and brightness of immobilized iridium (III)**

Lewis, D., Dore, V., Rogers, N. J., Mole, T., Nash, G. B., Angeli, P. & Pikramenou, Z., 2013, In: Langmuir. 29, 47, p. 14701-14708

#### **Controlled assembly of heterometallic lanthanide (III) macrocycles: incorporation of photoactive and highly paramagnetic metal centres within a single complex**

Lewis, D., Moretta, F. & Pikramenou, Z., 2012, In: Supramolecular Chemistry. 24, 2, p. 135-142

#### **Evaluation of quinoline as a remote sensitizer for red and near-infrared emissive lanthanide (III) ions in solution and the solid state**

Lewis, D., Moretta, F., Holloway, A. & Pikramenou, Z., 2012, In: Dalton Transactions. 41, p. 13138-13146

#### **Luminescent ruthenium (II) tris-bipyridyl complex caged in nanoscale silica for particle velocimetry studies in microchannels**

Lewis, D., Dore, V., Goodwin, M., Savage, A., Nash, G. B., Angeli, P. & Pikramenou, Z., 2012, In: Measurement Science and Technology. 23, 9 p., 084004.

#### **pH-controlled delivery of luminescent europium coated nanoparticles into platelets**

Davies, A., Lewis, D., Watson, S., Thomas, S. & Pikramenou, Z., 2012, In: Proc Natl Acad Sci U S A.. 109, 6, p. 1862-1867

#### **Intracellular synchrotron nanoimaging and DNA damage/genotoxicity screening of novel lanthanide-coated nanovectors**

Lewis, D., Bruce, C., Bohic, S., Cloetens, P., Hammond, S. & Pikramenou, Z., 2010, In: nanomedicine. 5, 10, p. 1547-1557

#### **Purely heterometallic lanthanide (III) macrocycles through controlled assembly of disulfide bonds for dual color emission**

Lewis, D., Glover, P., Solomons, M. & Pikramenou, Z., 2010, In: Journal of the American Chemical Society. 133, 4, p. 1033-1043

#### **Luminescent nanobeads: attachment of surface reactive Eu (III) complexes to gold nanoparticles**

Lewis, D., Day, T., Macpherson, J. & Pikramenou, Z., 2006, In: Chemical Communications. 13, p. 1433-1435

#### **Highly luminescent, triple- and quadruple-stranded, dinuclear Eu, Nd, and Sm(III) lanthanide complexes based on bis-diketonate ligands**

Bassett, A., Magennis, S. W., Glover, P., Lewis, D., Spencer, N., Parsons, S., Williams, R., De Cola, L. & Pikramenou, Z., 2004, In: Journal of the American Chemical Society. 126, 30, p. 9413-9424

## **Prizes**

### **Exceptional Performance Award**

Lewis, David (Recipient), 2022

**Exceptional Performance Award**

Lewis, David (Recipient), 2019

**Fellow of the Institute of Materials, Minerals and Mining (FIMMM)**

Lewis, David (Recipient), 18 Aug 2023

**Highly cited author (top 10%) in RSCs 'General Chemistry' portfolio of journals (2016)**

Lewis, David (Recipient), 2016

**IAAM Medal**

Lewis, David (Recipient), 2021

**IChemE Global Awards - Oil and Gas Category Finalist**

Lewis, David (Recipient), 2017

**Making a Difference Award (Commended)**

Lewis, David (Recipient), 2021

**Named as an RSC Advances 'Emerging Investigator'**

Lewis, David (Recipient), 2021

**Students' Union Award - Best Lecturer, Faculty of Science and Engineering (Nominee)**

Lewis, David (Recipient), 17 Apr 2018

**SW Challinor Prize**

Lewis, David (Recipient), 2007

**Projects****Direct Writing of Nanodevices: A Sustainable Route to Nanofabrication**

Lewis, D., PI, Materials Engineering

Boland, J., Col, EEE - Academic & Research

Winpenny, R., Col, Materials Chemistry

Finance Code

R128568

1/05/23 → 30/04/26