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

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: Mo1–xWxS2 and Mo1–xWxO3 Alloys (0 ≤ x ≤ 1)’ Chem. Mater. 2020, 32, 7895–7907. DOI: 10.1021/acs.chemmater.0c02685

Superhydrophobic nanomaterials:
Hybrid Perovskites:
Alam, F.; Lewis, D.J.* ‘Thin films of formamidinium lead iodide (FAPI) deposited using aerosol assisted chemical vapour deposition (AACVD)’ Sci. Rep. 2020, 10, 22245. DOI: 10.1038/s41598-020-79291-1

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
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 SrTiO₃

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

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

Exceptional Thermoelectric Performance of Cu₂(Zn,Fe,Cd)SnS₄ Thin Films
A combined experimental and modelling approach for the evaluation of the thermoelectric properties of Ag-doped SnS

Enhancing the thermoelectric properties of TiO2-based ceramics through addition of carbon black and graphene oxde

Thermoelectric performance of tetrahedrite (Cu12Sb4S13) thin films: the influence of the substrate and interlayer

Fabrication of High Quality Bornite and Chalcopyrite Thin Films by Aerosol Assisted Chemical Vapour Deposition
Barde, A. & Lewis, D. J., 10 Jul 2023, In: The Journal of Physical Chemistry C.

A Low-Temperature Synthetic Route Toward a High-Entropy 2D Hexernary Transition Metal Dichalcogenide for Hydrogen Evolution Electrocatlysis

Enhanced Thermoelectric Performance of Tin(II) Sulfide Thin Films Prepared by Aerosol Assisted Chemical Vapor Deposition

Environment effects upon electrodeposition of thin film copper oxide nanomaterials

Precursor-Led Grain Boundary Engineering for Superior Thermoelectric Performance in Niobium Strontium Titanate

Spherical hydroxyapatite nanoparticle scaffolds for reduced lead release from damaged perovskite solar cells

Quantum Confined High Entropy Lanthanide Oxysulfide Colloidal Nanocrystals

Tunable structural and optical properties of Ag-Cu-InS2 colloidal quantum dots

High Entropy Metal Chalcogenides: Synthesis, Properties, Applications and Future Directions

Investigating the effect of steric hindrance within CdS single-source precursors on the material properties of AACVD and spin coat-deposited CdS thin films
Tunable structural, morphological and optical properties of undoped, Mn, Ni and Ag-doped CuInS₂ thin films prepared by AACVD

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

Sustainable ITO films with reduced indium content deposited by AACVD

Nanoscale Chevrel Phase Mo₆S₈ Prepared by a Molecular Precursor Approach for Highly Efficient Electrocatalysis of the Hydrogen Evolution Reaction in Acidic Media

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

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

High Performance Nanostructured MoS₂ Electrodes with Spontaneous Ultra-Low Gold Loading for Hydrogen Evolution

Flexible nanoporous activated carbon for adsorption of organics from industrial effluents

Molecular Precursor Route to Bournonite (CuPbSbS₃) Thin Films and Powders

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

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

Intrinsic Effects of Thickness, Surface Chemistry and Electroactive Area on Nanostructured MoS₂ Electrodes with Superior Stability for Hydrogen Evolution

Tunable Structural and Optical Properties of CulnS₂ Colloidal Quantum Dots as Photovoltaic Absorbers
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

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

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

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

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

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

A Rapid and Low Temperature Molecular Precursor Approach Toward Ternary Layered Metal Chalcogenides and Oxides: Mo1-xWxS2 and Mo1-xWxO3 alloys (0 ≤ x ≤ 1).

Synthesis of Indium Oxide Microparticles using Aerosol Assisted Chemical Vapour Deposition

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

A molecular precursor route to quaternary chalcogenide CFTS (Cu2FeSnS4) powders as potential solar absorber materials

Formation and Healing of Defects in Atomically Thin GaSe and InSe

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

Synthetic 2-D Lead Tin Sulfide Nanosheets with Tuneable Optoelectronic Properties from a Potentially Scalable Reaction Pathway
Accessing γ-Ga2S3 by solventless thermolysis of gallium xanthates: A low temperature limit for crystalline products?

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

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

Room Temperature Production of Nanocrystalline Molybdenum Disulfide (MoS2) at the Liquid-Liquid Interface

Solid solutions of M2-2xIn2xS3 (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

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

Decoupling Structure and Composition of CH3NH3PbI3–xBrx Films Prepared by Combined One-Step and Two-Step Deposition

Ambient-Air-Stable Inorganic Cs2SnI6 Double Perovskite Thin Films via Aerosol-Assisted Chemical Vapour Deposition

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

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

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

Direct Synthesis of MoS2 or MoO3 via Thermolysis of a Dialkyl Dithiocarbamato Molybdenum(IV) Complex
Exploiting Inherent Instability of 2D Black Phosphorus for Controlled Phosphate Release from Blow-Spun Poly (lactide-co-glycolide) Nanofibers

Full compositional control of PbSxSe1-x thin films by use of acylchalcogourato lead(II) complexes as precursors for AACVD

On the Phase Control of CuInS2 Nanoparticles from Cu-/In-Xanthates

Synthesis of Bi2-2-xSb2 xS3 (0 ≤ x ≤ 1) solid solutions from solventless thermolysis of metal xanthate precursors

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

Dual Functionalization of Liquid-Exfoliated Semiconducting 2H-MoS2 with Lanthanide Complexes Bearing Magnetic and Luminescence Properties

The influence of precursor on rhenium incorporation into Re-doped MoS2 (Mo1-xRe xS2) thin films by aerosol-assisted chemical vapour deposition (AACVD)

A Review of Two-Dimensional Nanomaterials Beyond Graphene

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

A Single Source Precursor for Tungsten Dichalcogenide Thin Films: Mo1-xWxS2 (0 ≤ x ≤ 1) Alloys by Aerosol-Assisted Chemical Vapor Deposition (AACVD)

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

Exploring the versatility of liquid phase exfoliation: Producing 2D nanosheets from talcum powder, cat litter and beach sand
Formation and Characterization of Model Iron Sulfide Scales with Disulfides and Thiols on Steel Pipeline Materials by an Aerosol Assisted Chemical Vapor Method

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

Property Self-Optimization During Wear of MoS2

Shining a Light on Transition Metal Chalcogenides for Sustainable Photovoltaics

Solution Processing of Two-Dimensional Black Phosphorus

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

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

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

Sequential bottom-up and top-down processing for the synthesis of transition metal dichalcogenide nanosheets: the case of rhenium disulfide (ReS2)

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

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

Biological Applications of Nanomaterials

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

Morphology and band gap controlled AACVD of CdSe and CdSxSe1−x thin films using novel single source precursors: Bis(diethylidithio/diselenocarbamato)cadmium(II)

Transition Metal Doped Pyrite (FeS2) Thin Films: Structural Properties and Evaluation of Optical Band Gap Energies

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

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

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

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

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

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

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

Ambient pressure aerosol-assisted chemical vapour deposition of (CH3NH3)PbBr3, an inorganic-organic perovskite important in photovoltaics

De Novo Design of Ln (III) Coiled Coils for Imaging Applications
Lanthanide-coated gold nanoparticles for biomedical applications

Luminescent gold surfaces for sensing and imaging: p: attering of transition metal probes

On the interaction of copper(II) with disulfiram

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

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

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

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

pH-controlled delivery of luminescent europium coated nanoparticles into platelets

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

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

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

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

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., CoI, EEE - Academic & Research
Winpenny, R., CoI, Materials Chemistry
Finance Code R128568
1/05/23 → 30/04/26