

## THE HINSHELWOOD LECTURES 2026



### Professor Dame Clare Grey FRS University of Cambridge

*Towards a Net Zero World: Developing and applying new tools to understand how batteries function, from lab to marketplace*

#### Lecture 1: Tuesday, 12<sup>th</sup> May (Introduction)

**What is a battery?** What are the challenges and some new directions?

**Local structure: NMR methods for batteries.** NMR of paramagnetic materials - oxidation states and local structure. From spinels to layered structures. DFT studies of NMR hyperfine shifts.

#### Lecture 2: Tuesday, 19<sup>th</sup> May (New operando methods: *In-situ* NMR)

**Method development and applications:** (i) batteries (e.g., silicon, hard carbons and lithium plating), (ii) supercapacitors (charging mechanisms, local structure and capacitance), and (iii) gated electronics (e.g., PEDOT-PSS).

#### Lecture 3: Thursday, 21<sup>st</sup> May (Charge Photometry: From local- to particle-level experiments)

**Understanding phase transitions:** LiCoO<sub>2</sub> and graphite. Extracting diffusion coefficients and role on electrochemical phase transitions - kinetic vs. thermodynamic control; comparison with LiFePO<sub>4</sub>.

#### Lecture 4: Tuesday, 26<sup>th</sup> May (Battery degradation)

**Uncoupling the different anode vs. cathode processes.**

#### Lecture 5: Thursday, 28<sup>th</sup> May (Scaling up, charging faster)

**Redox flow batteries, fast charging anodes and future directions.**

The Lectures (generously sponsored by Refeyn Ltd) will be presented in the PTCL Main Lecture Theatre at 11.15 am.

They will be of particular interest to researchers and senior undergraduates.