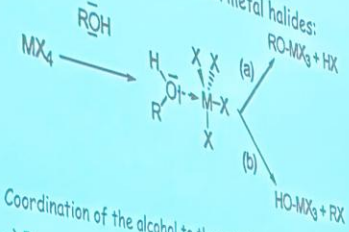
Nonaqueous Sol-Gel Routes to Oxides

1. Nonhydrolytic Hydroxylation Reactions

(Formation of M-OH species)

Reaction of alcohols with metal halides:



1) Coordination of the alcohol to the metal centre

2) a) Formation of metal alkoxide under elimination of HX

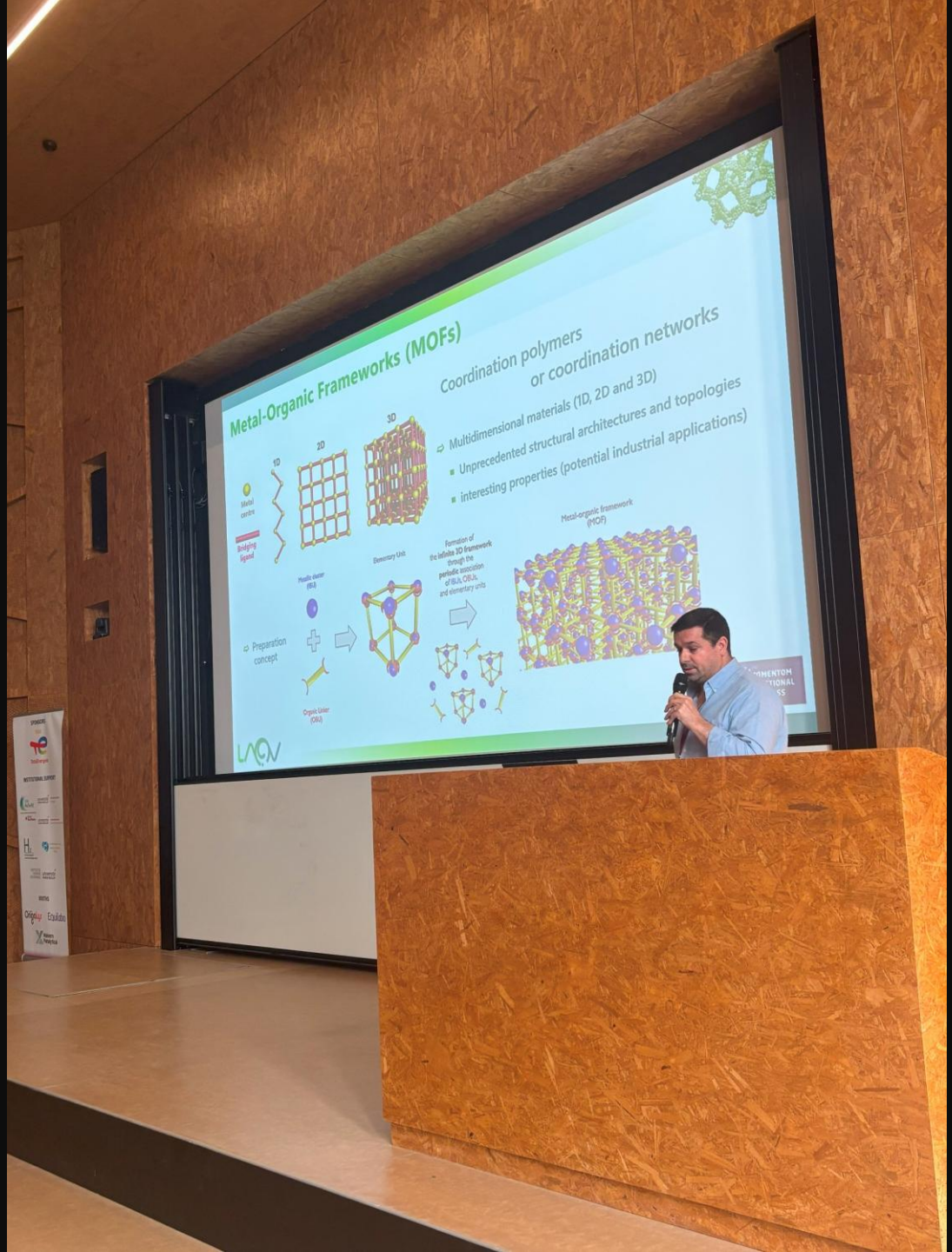
b) Formation of hydroxyl group and elimination of alkyl halide RX
(if R is an electron-donor substituent, the nucleophilic attack of the chloride on the carbon group is favored)

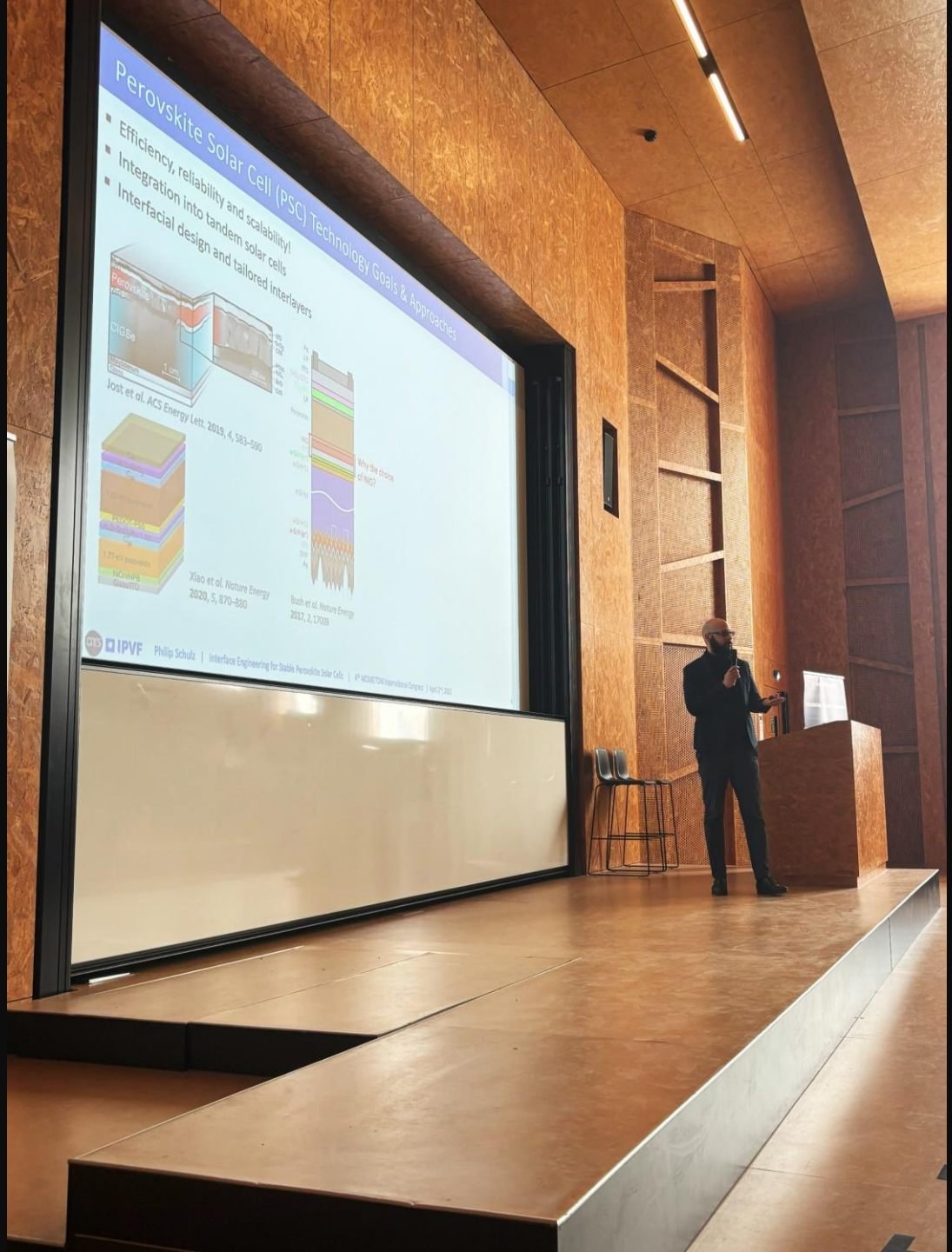
A. Vioux: Chem. Mater. 1997, 9, 2292-2299


Li-Ion Batteries: Exploring Volumetric Changes in Electrodes
Electron
Lithium
Discharge
Charge
Cu Current Collector
Al Current Collector
Graphite
Separator & Electrolyte
Transition Metal Oxide
Graphite
+ Lithium
Carbon
Lithiated-Graphite
Volumic expansion 10%
Silicium
Si
+ Lithium
Lithiated-Silicium
- Lithium
+ Lithium
a-Si
Volumic expansion 300%
Li electrodeposition
MOMENTOM – April 4th


See-through Photovoltaics
Aldo Di Carlo
CHOSE - University of Rome Tor Vergata (Italy)
Institute of Structure of Matter - CNR (Italy)
TOR VERGATA
CHOSE


Concluding remarks
Probabilistic approaches needed to assess the SoS of multi-energy networks strongly based on variable RES
Modelling challenges
Simple but adequate laws for components and their interactions (system)
Reliability models
Computation challenges
Need to obtain statistically
time
Monte Carlo methods are not
high level of SoS...
April 3, 2025
SUPPORT
GRADUATE SCHOOL Chimie
GRADUATE SCHOOL Economics & Management
niversité
RIS-SACLAY
HS
Equilabo
alvern
nalytical


Metal-Organic Frameworks (MOFs)
Coordination polymers
or coordination networks
Multidimensional materials (1D, 2D and 3D)
Unprecedented structural architectures and topologies
interesting properties (potential industrial applications)
1D
2D
3D
Metal centre
Bridging ligand
Nodes cluster (SBU)
Elementary Unit
Formation of the infinite 3D framework through the periodic association of SBUs, CBUs and elementary units
Metal-organic framework (MOF)
Preparation concept
Organic Linker (CBUs)


Perovskite Solar Cell (PSC) Technology Goals & Approaches
Efficiency, reliability and scalability!
Integration into tandem solar cells
Interfacial design and tailored interlayers
Perovskite
CIGSe
1 µm
Jost et al. ACS Energy Lett. 2019, 4, 583−590
Xiao et al. Nature Energy 2020, 5, 870–880
Bush et al. Nature Energy 2017, 2, 17009
Why the choice of NiO?
IPVF
Philip Schulz | Interface Engineering for Stable Perovskite Solar Cells


LOHCs
LOHCs
Advantages/drawbacks
Various strategies
I - SAFHYR project
I - SAFHYR project - hydrogenation
I - SAFHYR project - transfer hydrogenation
I - SAFHYR project - Dehydrogenation
II - UnLOHCked European project
III - Vicinal diols
III - Set-up
III - Test in different reactors - 175°C
III - Catalyst lifetime
III - Comparison / other LOHC systems
CONCLUSION
Thanks
Upstream coupling (electrolysis + hydrogenation)
Desert
Electrolysis
Direct use (fuel-cell)
H_2
Liquid H_2-lean molecule
Liquid H_2-rich molecule (RT, P_{amb})
Costly and unsafe storage and transportation
Easy and safe storage and transportation
Downstream coupling (dehydrogenation + FC)
Town
Direct use (fuel-cell)
H_2
Liquid H_2-rich molecule (RT, P_{amb})
Liquid H_2-lean molecule
Ircelyon

1: Clustering Results for LIHTC vs. big consumers

Low - Income High Transport Costs (3.2% French households)

Single individuals
And single-parent
Poorest 20%
Employees
Urban with a car

Single individuals
Poorest 20%
Retired men
Rural areas

Large families
30% poorest
Self-employed, farmers and employees
Multiple cars
Rural & commuting areas

Twice the median (20% French households)

Large families
30% richest
Self-employed
Commuting areas
Multiple cars

Retired
50% poorest
Commuting areas

Single individual or single-parent households
40% poorest
Commuting and rural areas

Profiting from merging photocatalysis with catalysis

Wojciech Macyk, Taymaz Tabari, Marcin Kobielusz

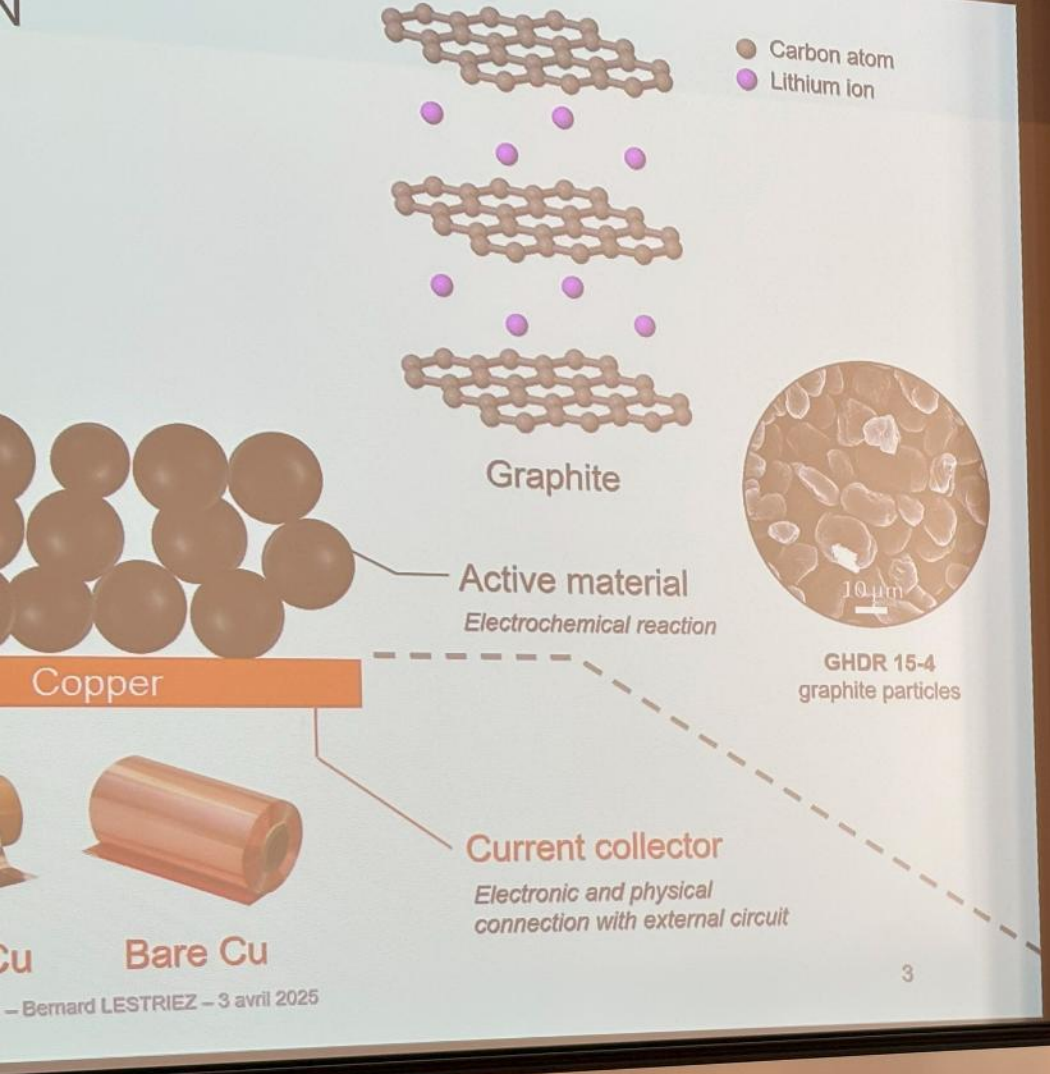
Faculty of Chemistry, Jagiellonian University

macyk@chemia.uj.edu.pl

www.photocatalysis.eu, www.fotokataliza.pl

JAGIELLONIAN UNIVERSITY IN KRAKOW

TEAM of photocatalysis


Carbon atom
Lithium ion
Graphite
Active material
Electrochemical reaction
10 µm
GHDR 15-4
graphite particles
Copper
Current collector
Electronic and physical
connection with external circuit
Bare Cu
3
– Bernard LESTRIEZ – 3 avril 2025


cea
liten
Elucidating new synthesis procedures for sodium solid electrolytes
Sergio F. MAYER*, Laureline LECARME,
Claire VILLEVIEILLE, Jean-Baptiste DUCROS
Carnot project: CEA Grenoble – LEPMI
4th MOMENTOM INTERNATIONAL CONGRESS
02-04 APRIL 2025
ACCELERATING THE ENERGY TRANSITION
UNIVERSITÉ PARIS-SACLAY
91400 ORSAY - FRANCE
INFORMATION & REGISTRATION
Le réseau des INSTITUTS CARNOT
cnrs
UGA Université Grenoble Alpes
GRENOBLE INP UGA
UNIVERSITÉ SAVOIE MONT BLANC
RÉPUBLIQUE FRANÇAISE

MOMENTOM 2025

Introduction

Electro-activity

Applications

Super-reduced POMs

Results: $\{P_2W_{15}Mo_3\}$

Redox behaviour

Monitoring the reduction using EXAFS

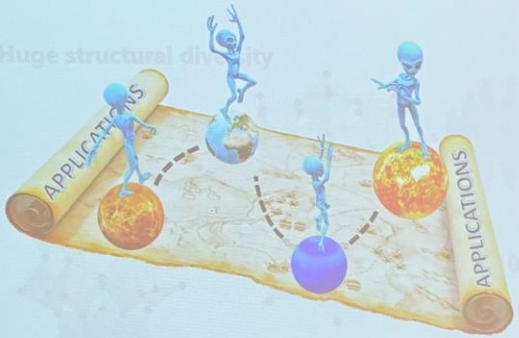
Characterization of the VI'

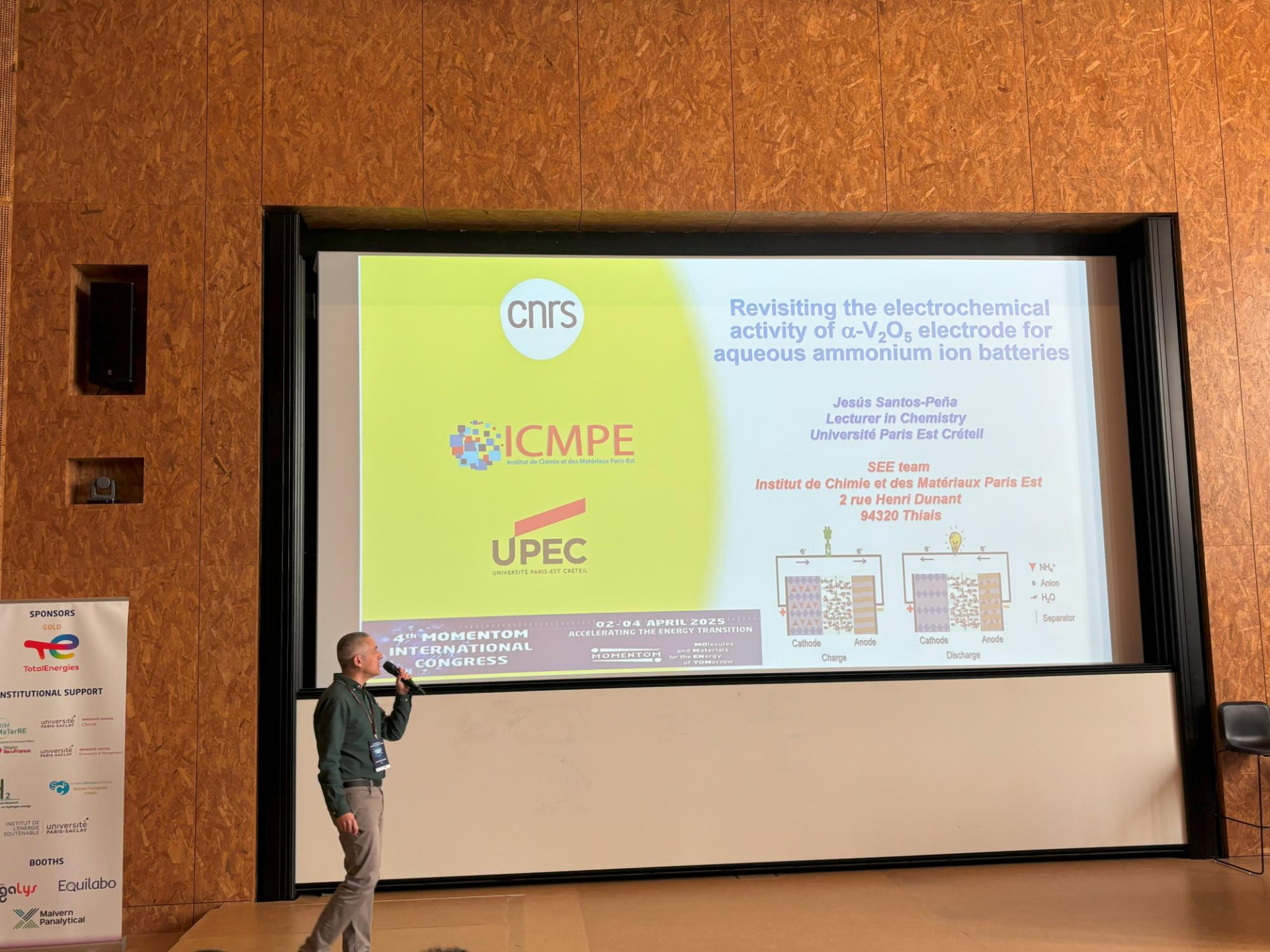
12 e- reduction of the POM

Take-home messages

WHAT IS A POLYOXOMETALATE (POM)?

Noteworthy redox properties!




cnrs
ICMPE
Institut de Chimie et des Matériaux Paris-Est
UPEC
UNIVERSITÉ PARIS-EST CRÉTEIL
Revisiting the electrochemical activity of α-V2O5 electrode for aqueous ammonium ion batteries
Jesús Santos-Peña
Lecturer in Chemistry
Université Paris Est Créteil
SEE team
Institut de Chimie et des Matériaux Paris Est
2 rue Henri Dunant
94320 Thiais
4th MOMENTOM INTERNATIONAL CONGRESS
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ACCELERATING THE ENERGY TRANSITION
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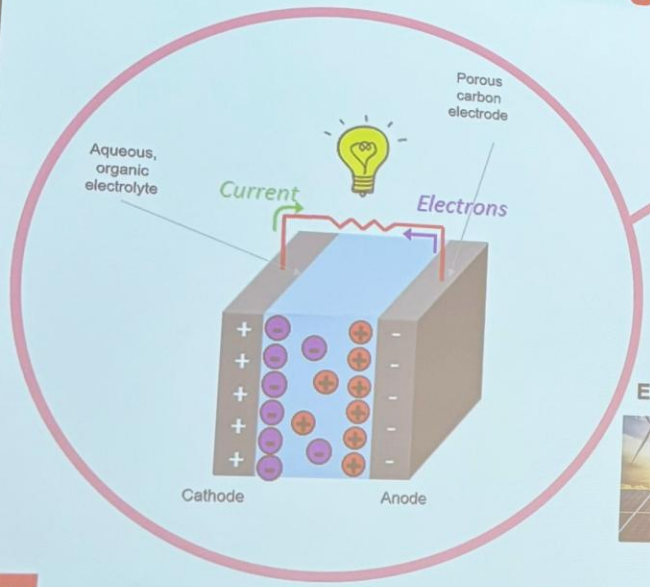
MOlecules and Materials for the ENergy of TOMorrow
Cathode
Anode
Charge
Cathode
Anode
Discharge
NH4+
Anion
H2O
Separator
SPONSORS
GOLD
TotalEnergies
INSTITUTIONAL SUPPORT
BOOTHS
Equilabo
Malvern Panalytical

Supercapacitor - energy storage device



Bike - Lithium-free, infinite autonomy

Energy storage

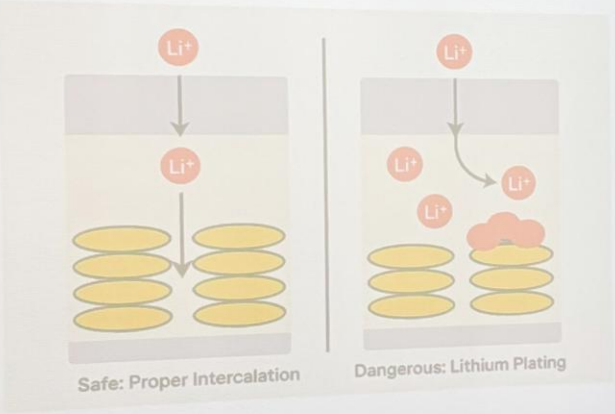
Transport - fast charging

> The Hidden Threat in EV Batteries: Lithium Plating

INTRODUCTION AND PURPOSE OF THE STUDY

CIC energiGUNE

What if your EV battery was silently self-destructing—every time you charged it fast in the cold?



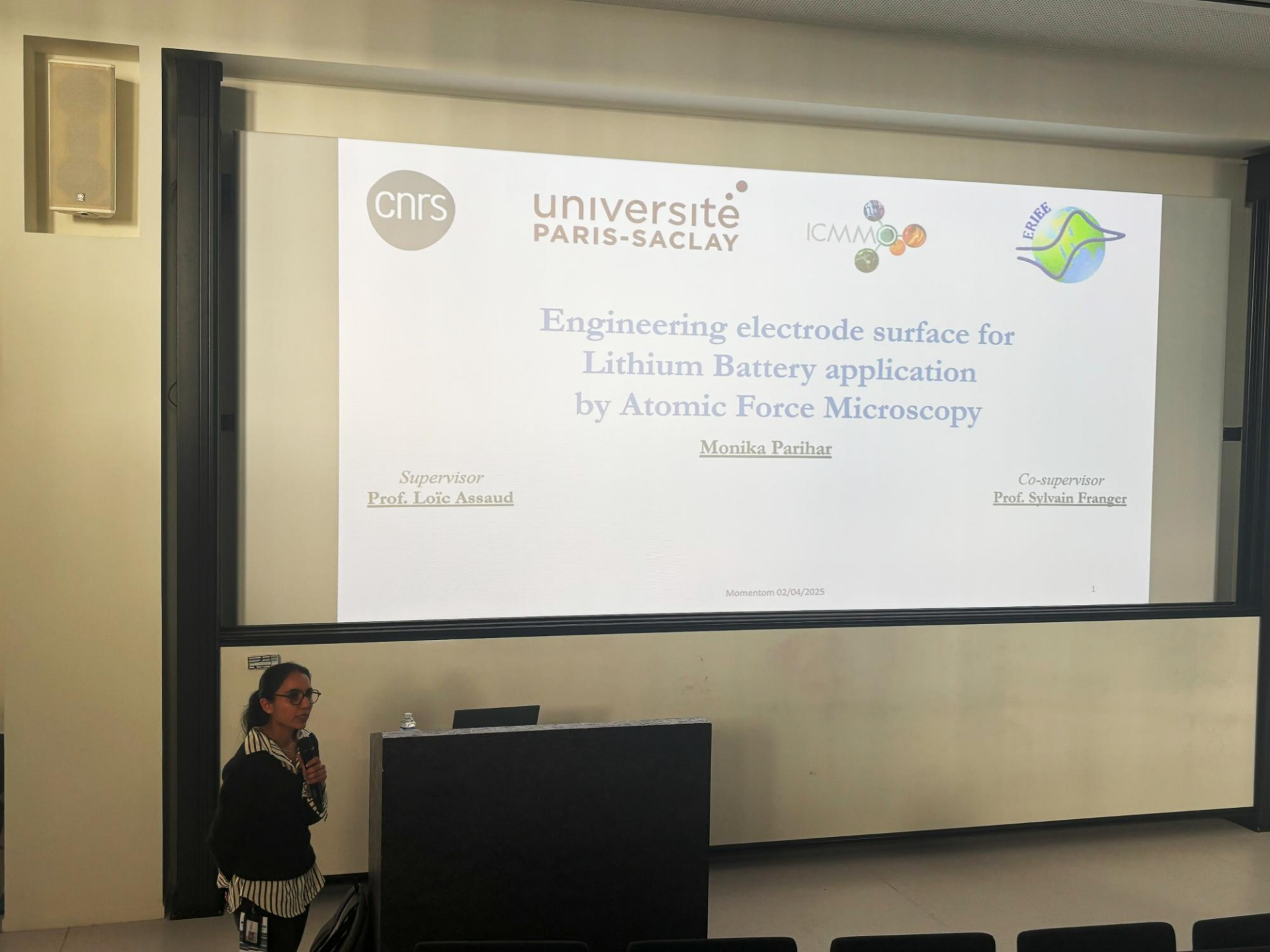
Trigger Conditions :

- ❄ Cold temperatures
- ⚡ Fast charging

Consequences :

- Capacity fade
- ⚠ Internal short circuits
- Fire hazard


How can we ensure the reliable characterization of electrode materials during their operation using operando XAS?
By using Full-Field Hyperspectral Imaging!
stephanie.belin@synchrotron-soleil.fr
S. Belin, A. Beauvois, V. Briois, A. Iadecola and F. La Porta
4TH MOMENTOM, April 02-04 2025
Rocking Optics for Chemical Kinetics
SOLEIL SYNCHROTRON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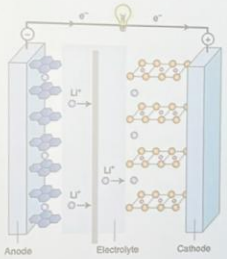
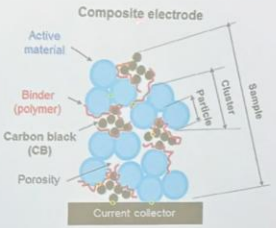
université
PARIS-SACLAY
ICMMO
ERIEE
Engineering electrode surface for
Lithium Battery application
by Atomic Force Microscopy
Monika Parihar
Supervisor
Prof. Loïc Assaud
Co-supervisor
Prof. Sylvain Franger
Momentom 02/04/2025
1

INTRODUCTION

- The composite electrodes introduce multiple limiting interfaces to charge transport in lithium-ion battery.
- Characterization of electronic and ionic transport across multiple interfaces using dielectric measurements





$$xLi^+ + xe^- + 6C \leftrightarrows Li_xC_6 (\text{ at the negative })$$
$$LiCoO_2 \leftrightarrows Li_{1-x}CoO_2 + xLi^+ + xe^- (\text{at the positive })$$

Goodenough, J. B. (2018). Nature Electronics, 1(3)
Badot, J. C., et al., (2016). Mat. Sci. and Eng.: B, 213.

INTRODUCTION

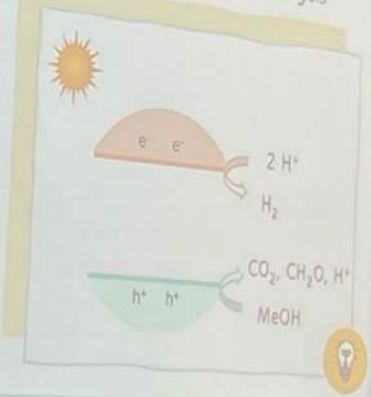
CONTEXT

POLLUTION

INCREASING ENERGY DEMAND

SOLAR DRIVEN ENERGY

H_2 production by photocatalysis



HEALTH RISK LINKED TO POLLUTION

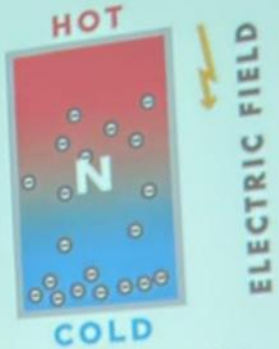
INCREASED RESISTANCE OF BACTERIA AND VIRUSES

A. Aigle and al. Science of The Total Environment 767 (2021) 145425

Introduction and Motivations

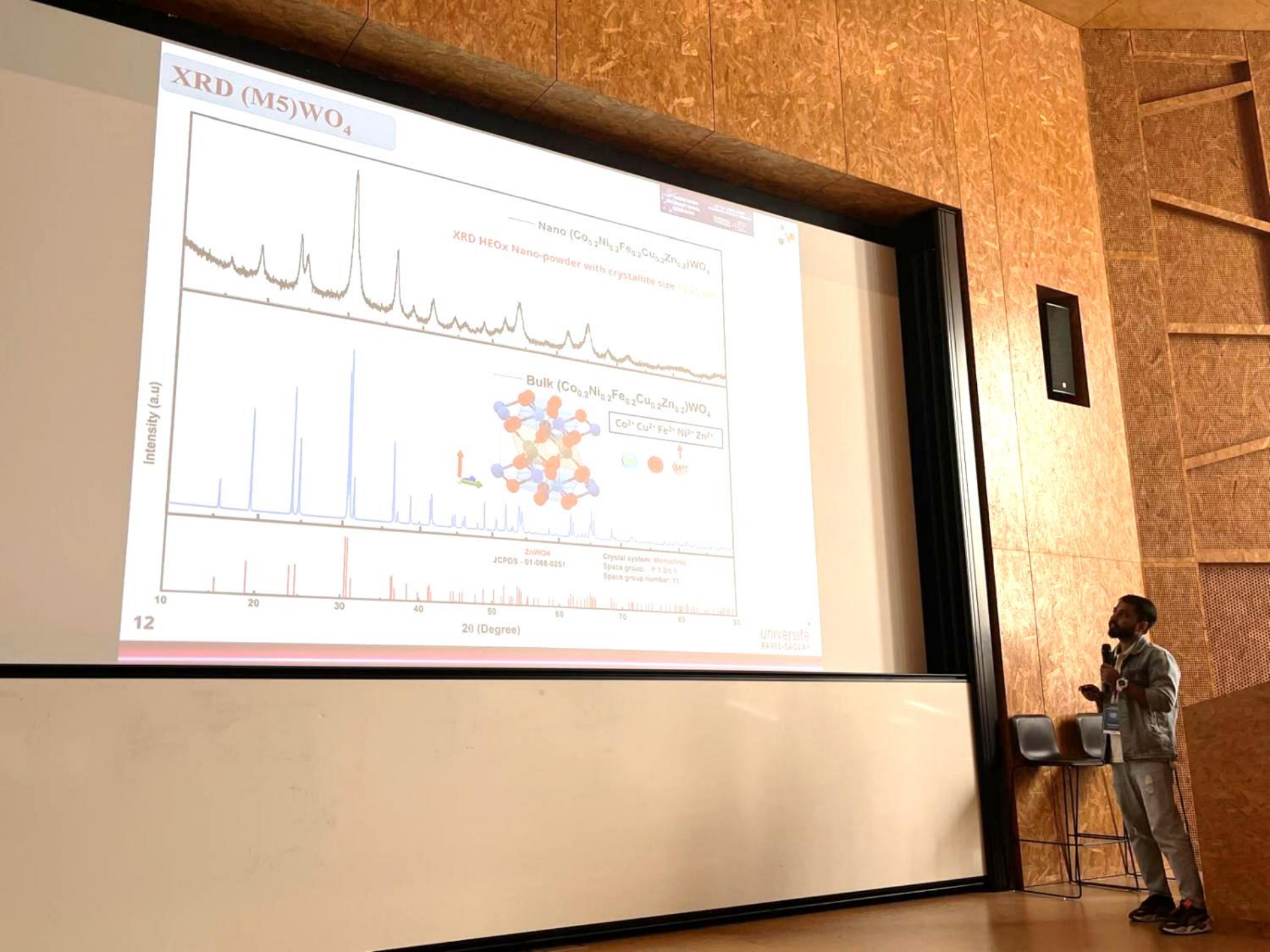
Goal: Harvesting low-grade heat.

- Thermoelectricity: Conversion of heat flow and electricity.



Seebeck effect in a solid-state thermoelectric material.*

*Taken from Thermoelectric Energy: How It Works and Its Applications - Contemporary Science and Innovation Spring 2018. https://sites.suffolk.edu/sgleeinsm/2018/03/06/thermoelectric-energy/)


XRD (M5)WO4
Nano (Co0.2Ni0.2Fe0.2Cu0.2Zn0.2)WO4
XRD HEOx Nano-powder with crystallite size
Bulk (Co0.2Ni0.2Fe0.2Cu0.2Zn0.2)WO4
Co2+ Cu2+ Fe2+ Ni2+ Zn2+
Intensity (a.u)
ZnWO4
JCPDS - 01-088-0251
Crystal system: Monoclinic
Space group: P 1 2/c 1
Space group number: 13
10
20
30
40
50
60
70
2θ (Degree)
12
Université PARIS-SACLAY