ALBA SYNCHROTRON

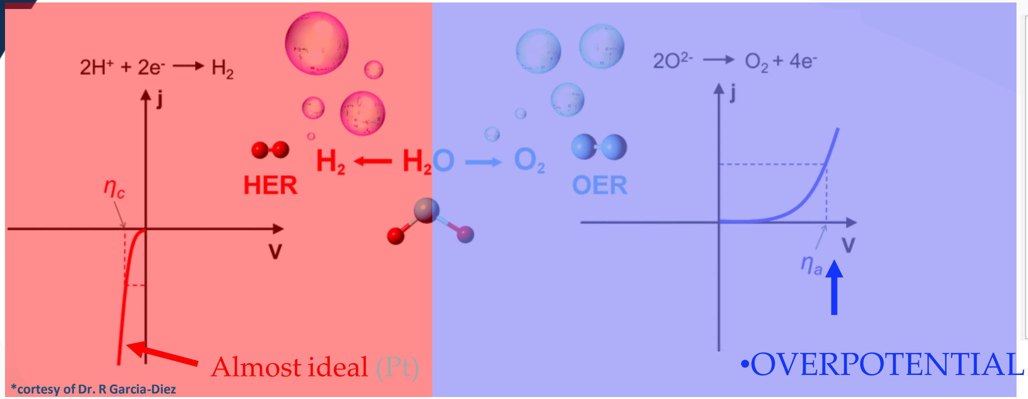
Plan de Recuperación, Transformación y Resiliencia
GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Financiado por la Unión Europea
NextGenerationEU

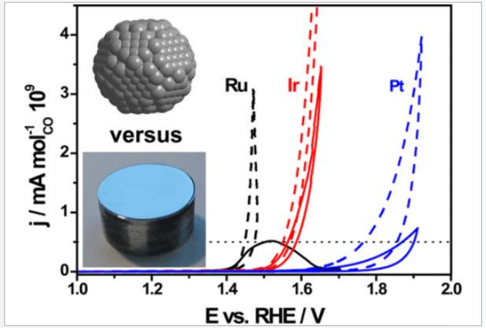
Controlling the number of coordinatively unsaturated iridium oxide active centers for optimize the electrocatalytic oxygen evolution reaction

Juan J. Velasco Vélez

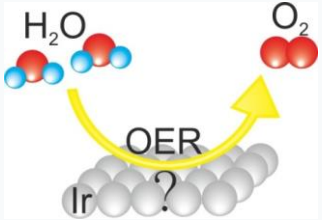
2nd September

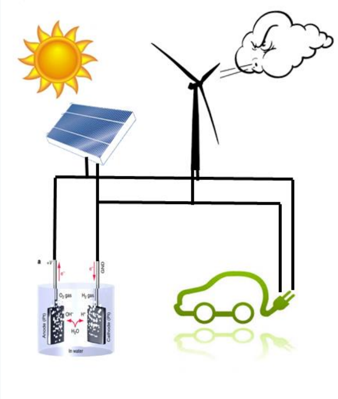
Oxygen evolution reaction (OER)

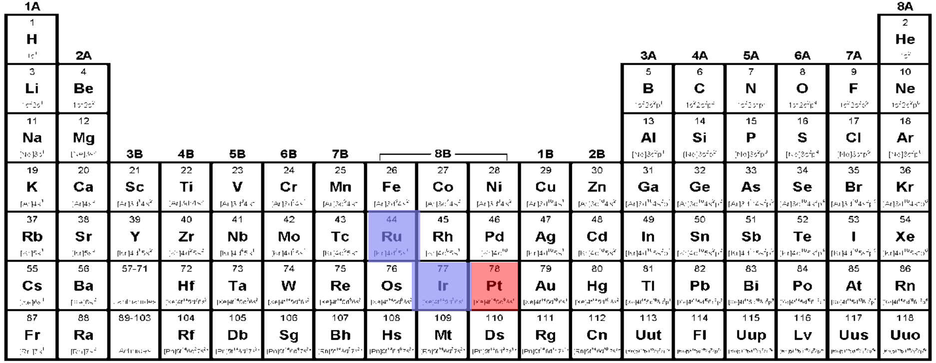




ACS Catal. 2012, 2, 8, 1765–1772







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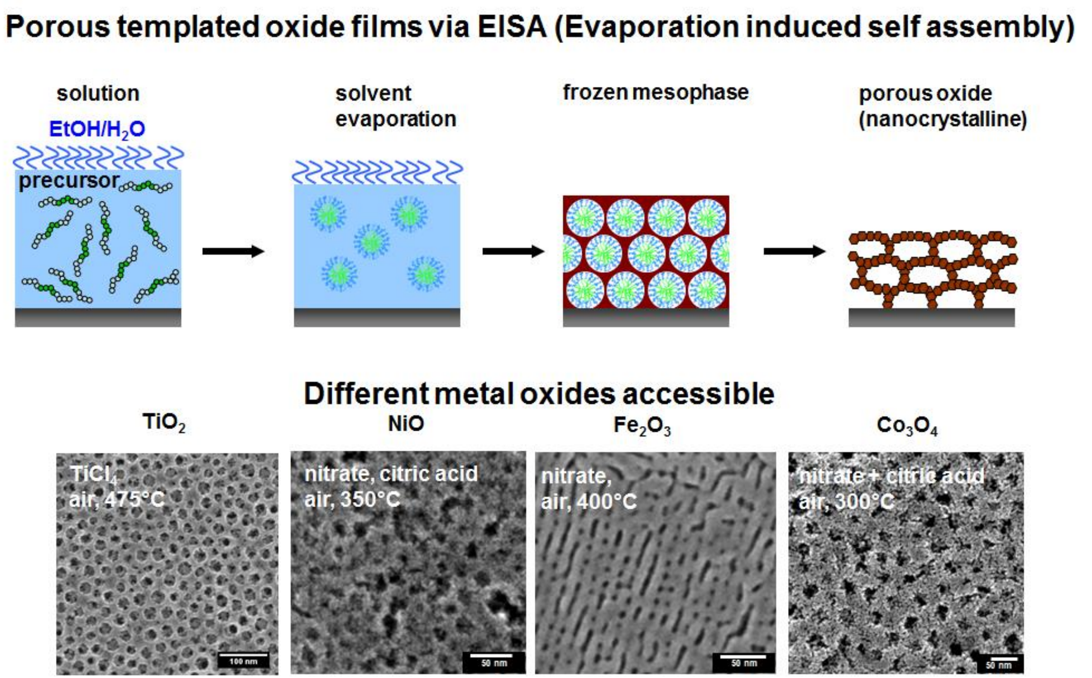
Mesoporous electrodes



The mesoporous IrO_x film was prepared by iridium acetate and micelles of amphiphilic block-copolymers using an evaporation-induced self-assembly (EISA) method, where the pore size is accurately controlled by the triblock copolymer.

Chemistry of materials 2013, 25(14), 2749-2758.

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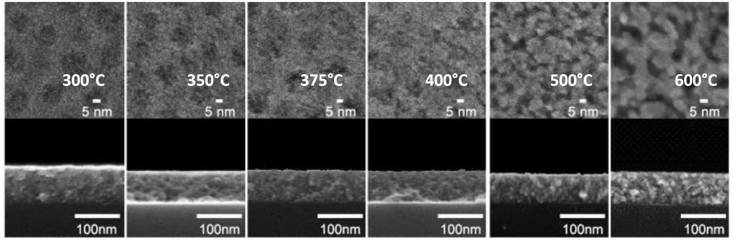
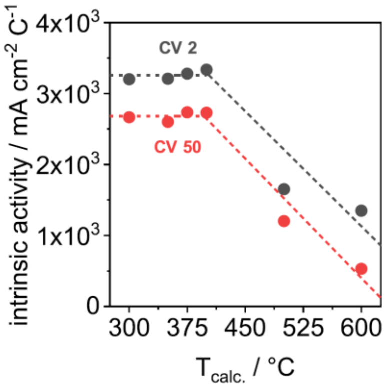
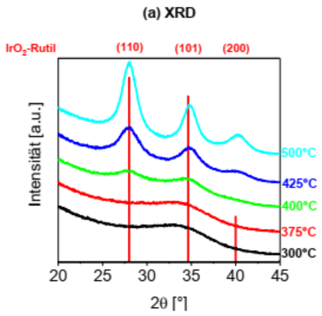
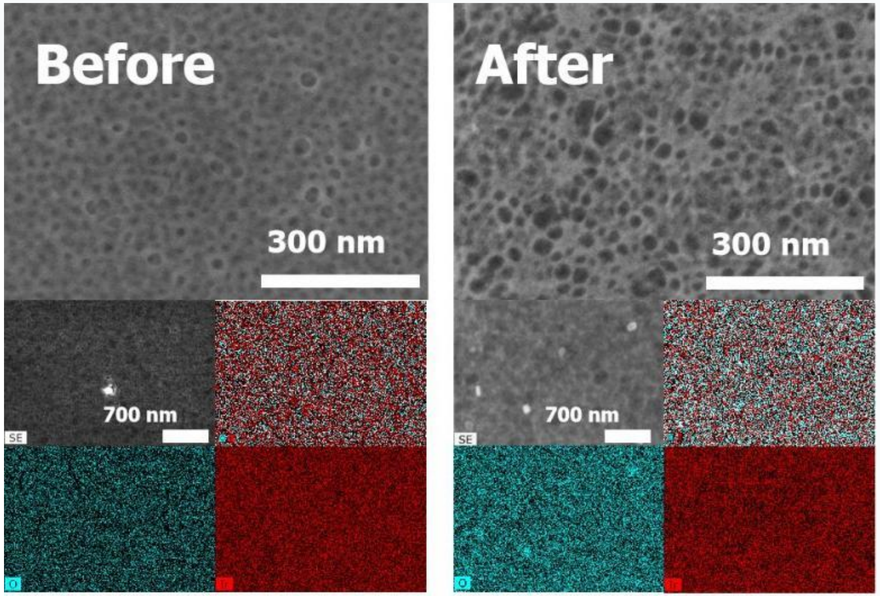
Mesoporous electrodes









Journal of The Electrochemical Society 2016, 163(11), F3132: **For calcined iridium films the optimal balance between activity and stability is reached between 400°C and 500°C.**

Chemistry of materials 2013, 25(14), 2749-2758.

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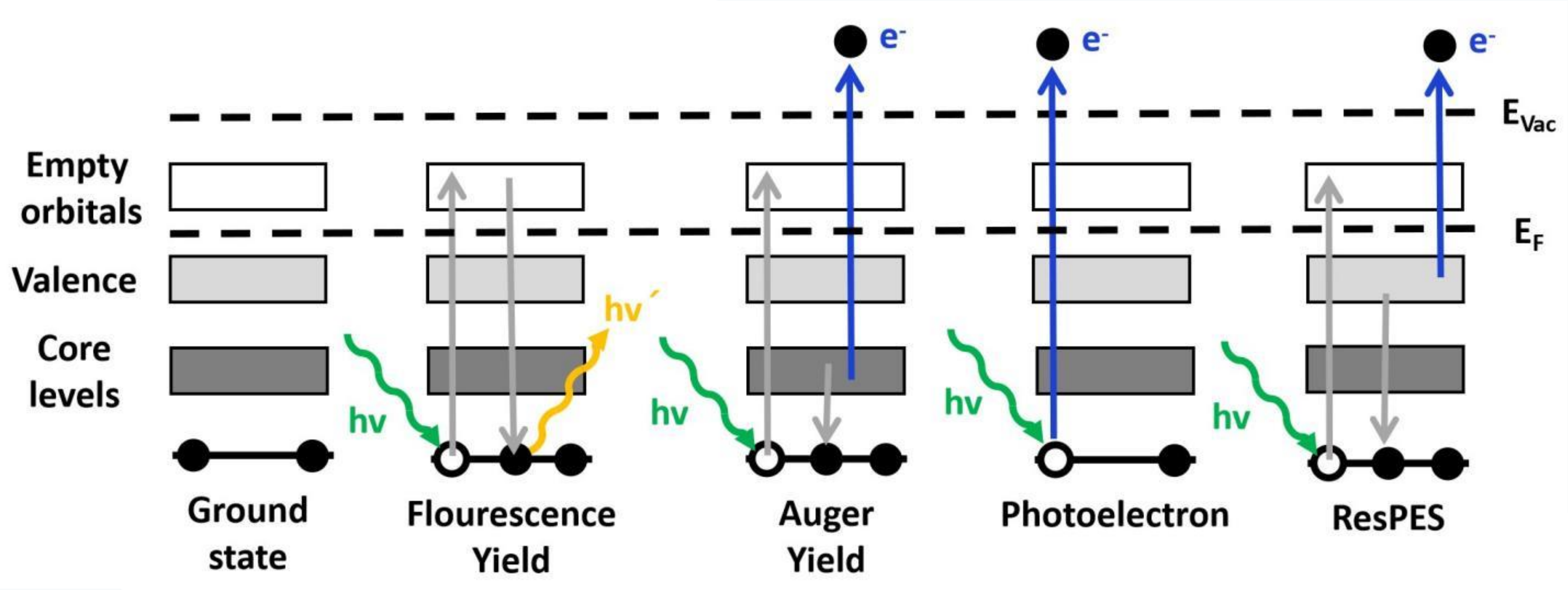
Photoelectron spectroscopy



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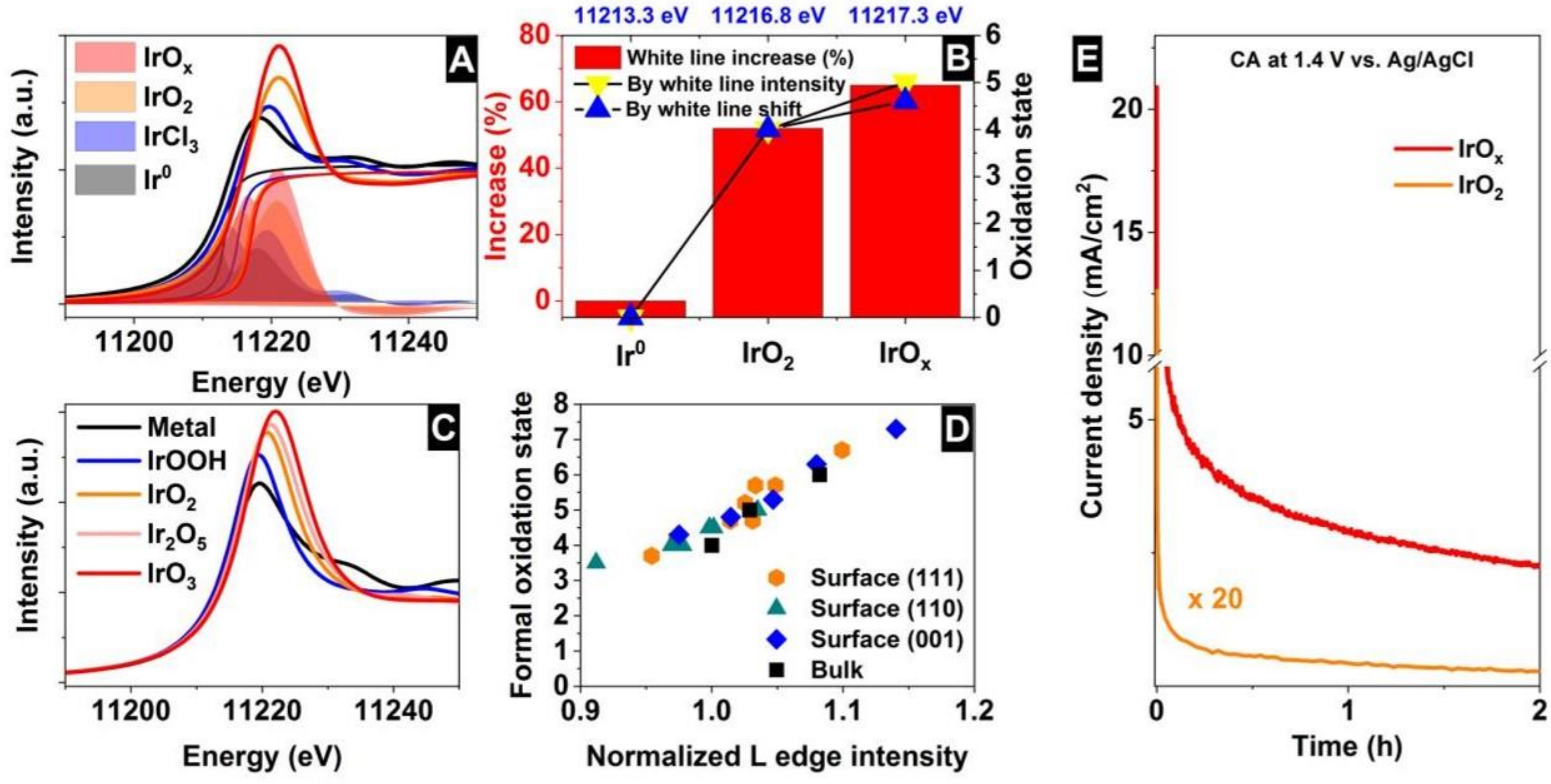
Ex situ, references samples



Velasco-Vélez *et al.*, JACS **2021**, 143, 12524

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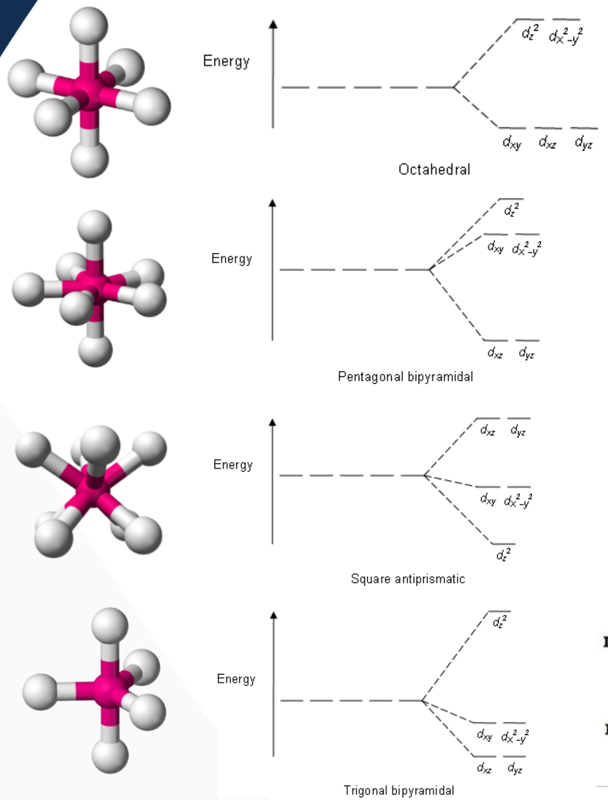
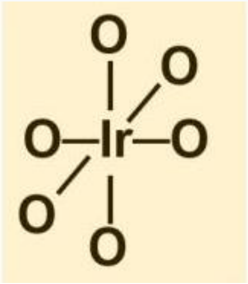
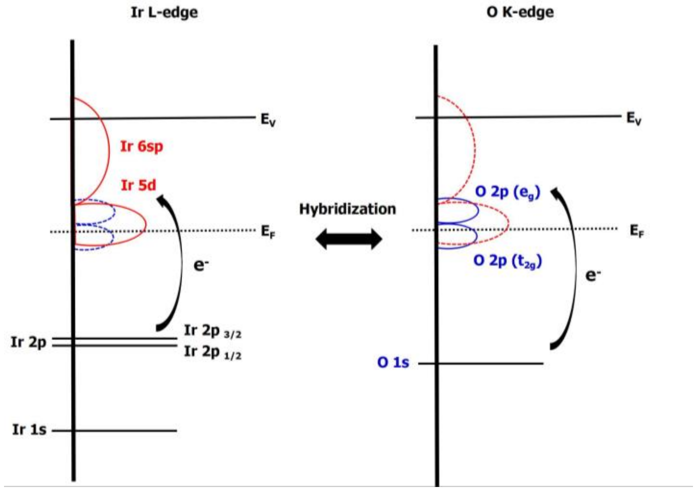
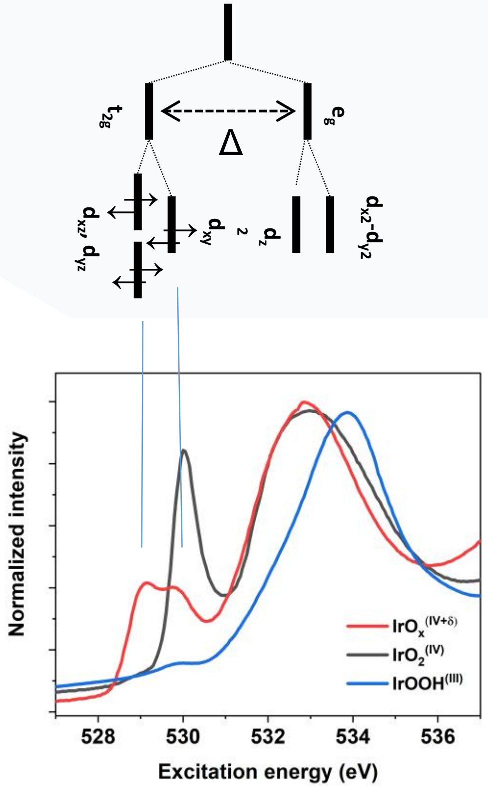
Oxidation state (crystal field IrO_x)









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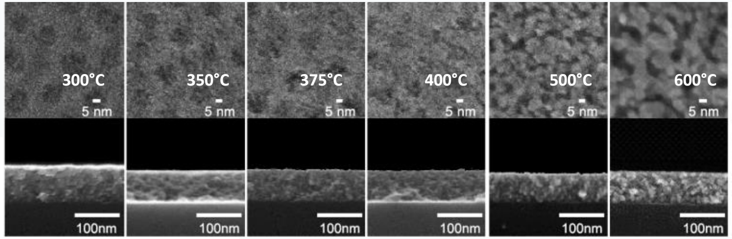

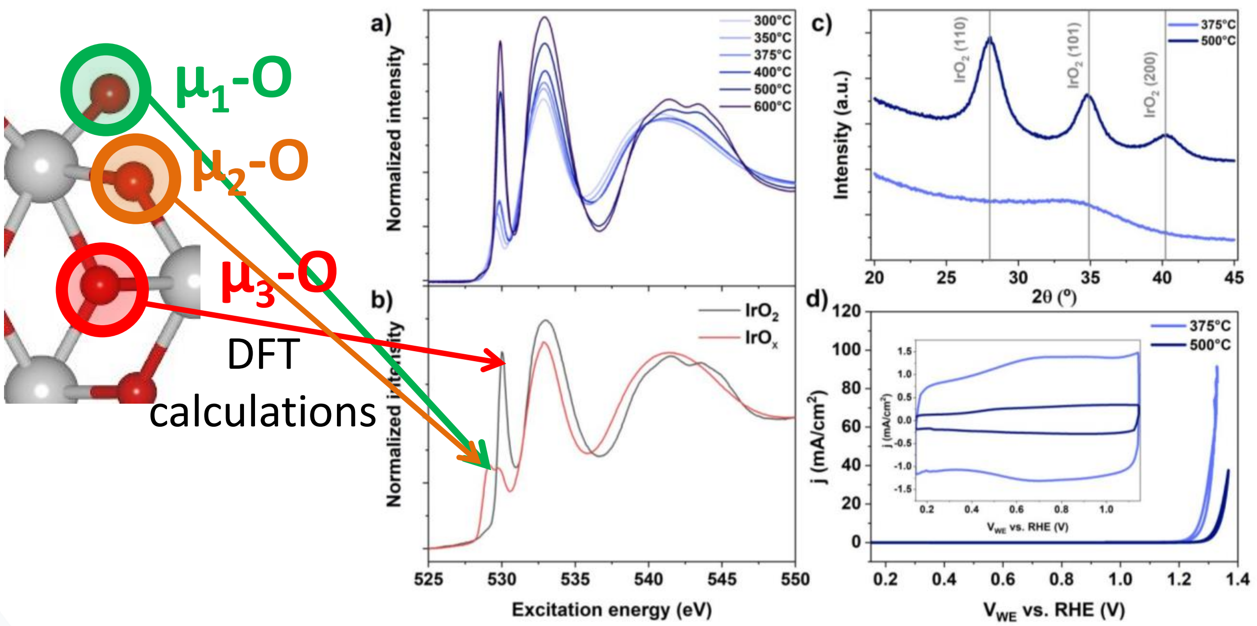

Advanced Energy Materials DOI: 10.1002/aenm.202303407

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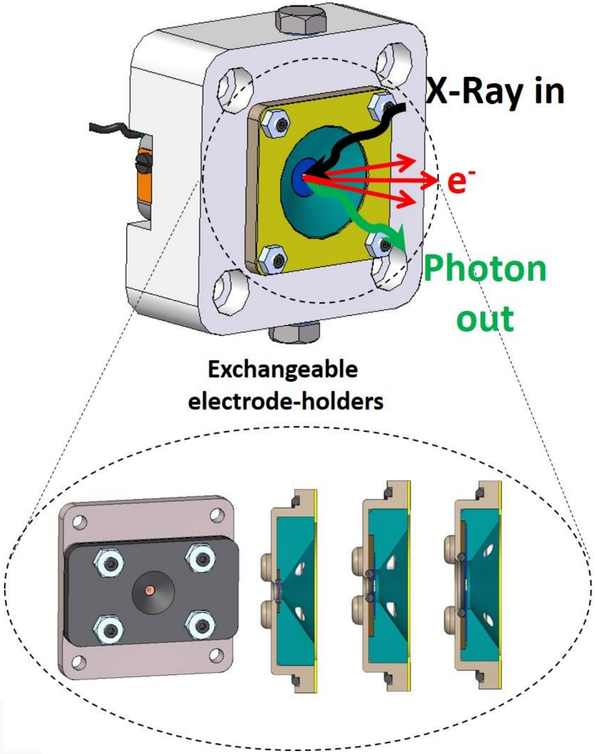
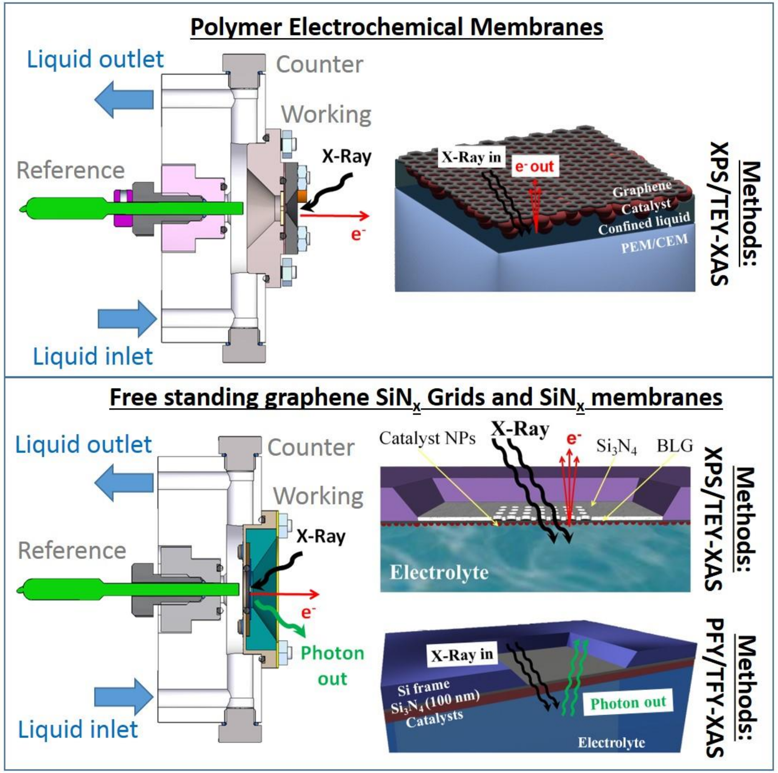
Operando electrochemical cell

In situ Electrochemical-Cell





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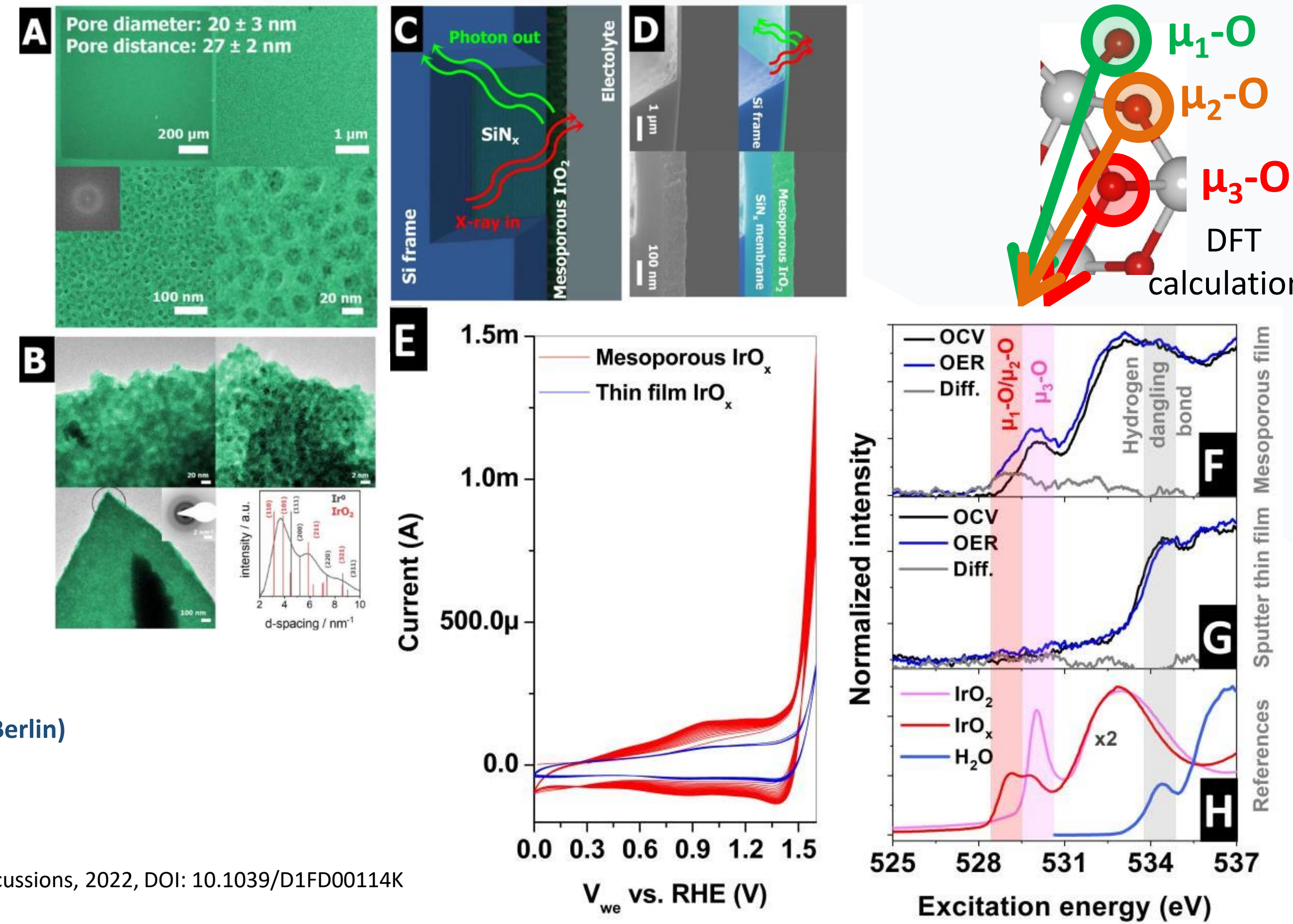
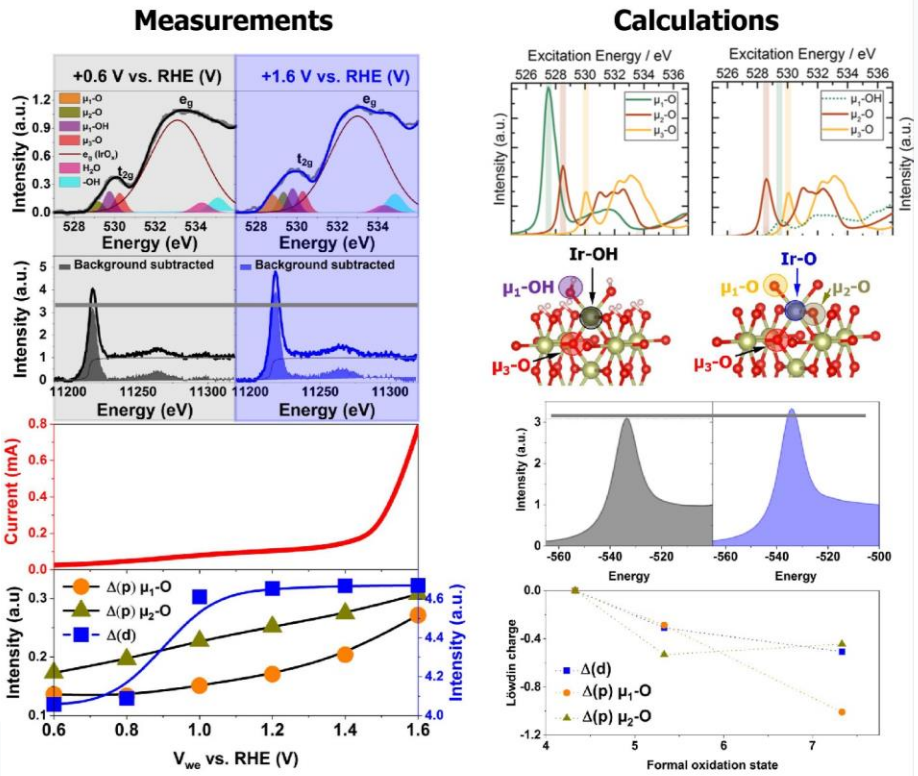
OER on IrO_x (Photon-in/Photon-out)

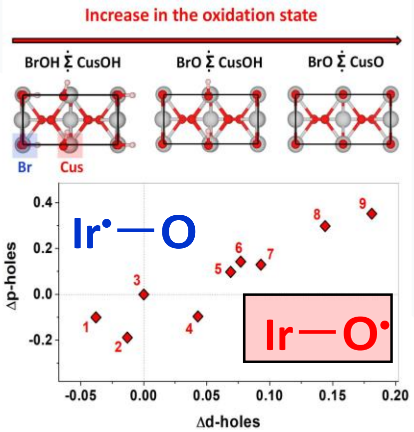


Dr. D. Bernsmeier (TU Berlin)

Velasco-Vélez *et al.*,Faraday Discussions, 2022, DOI: 10.1039/D1FD00114K

In situ O K-edge + Ir L_3-edge





T. Jones

Velasco-Vélez *et al.*, in preparation

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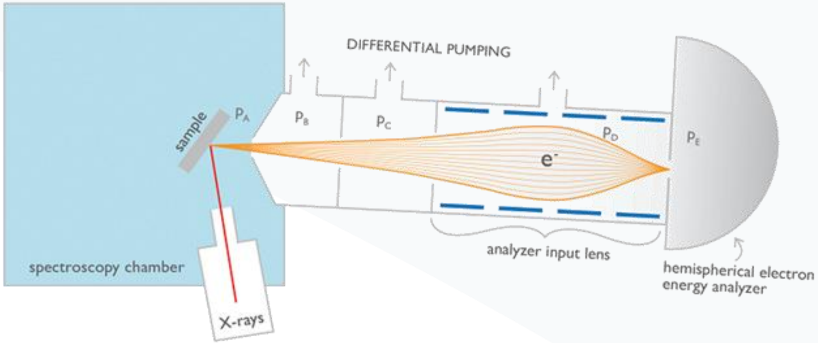
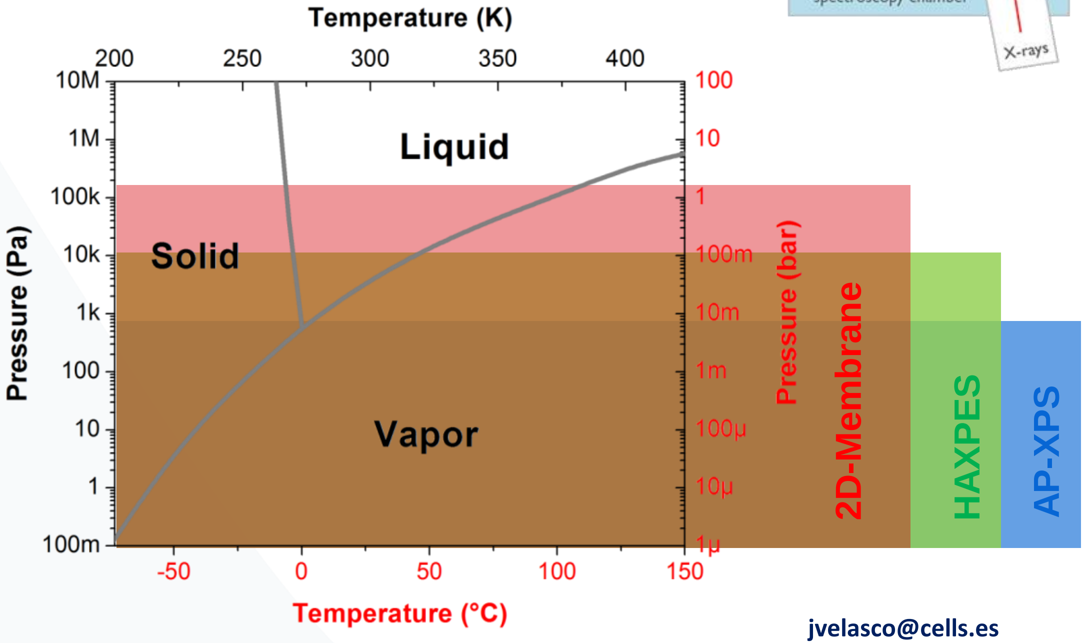
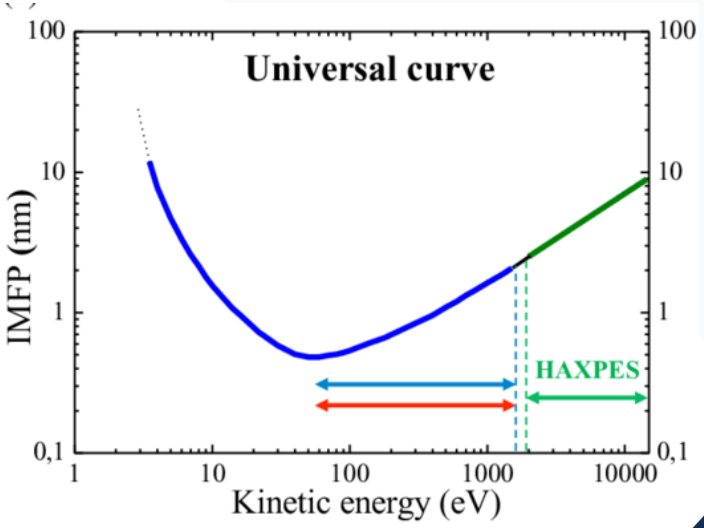
NAP-XPS







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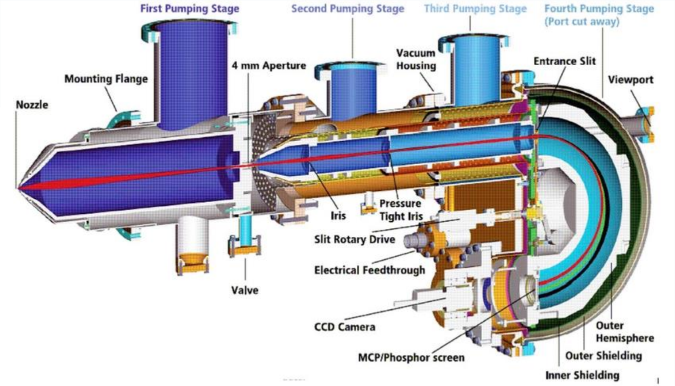
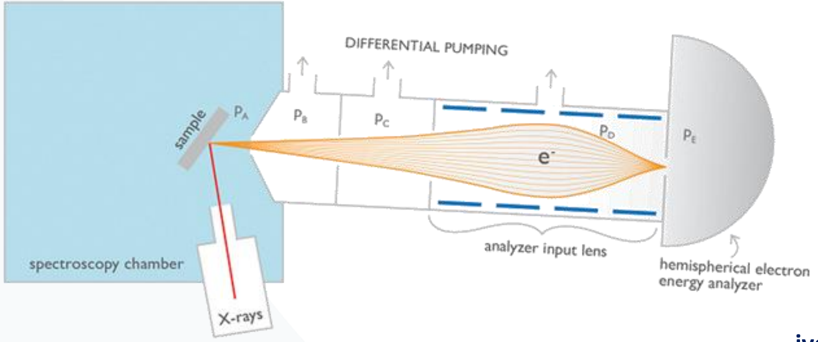
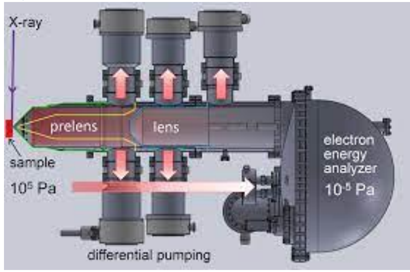
NAP-XPS

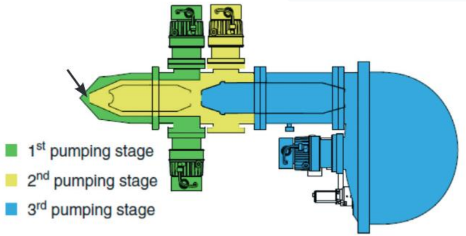
PHOIBOS 150 NAP analyzer



HiPP-3 NAP analyzer







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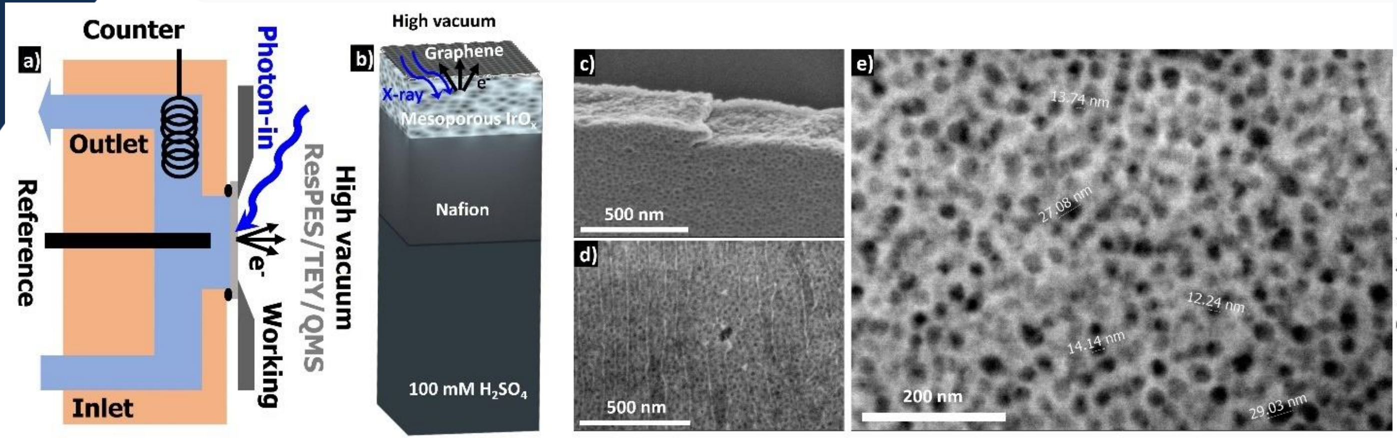

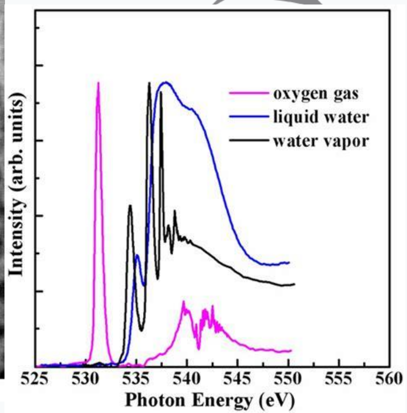

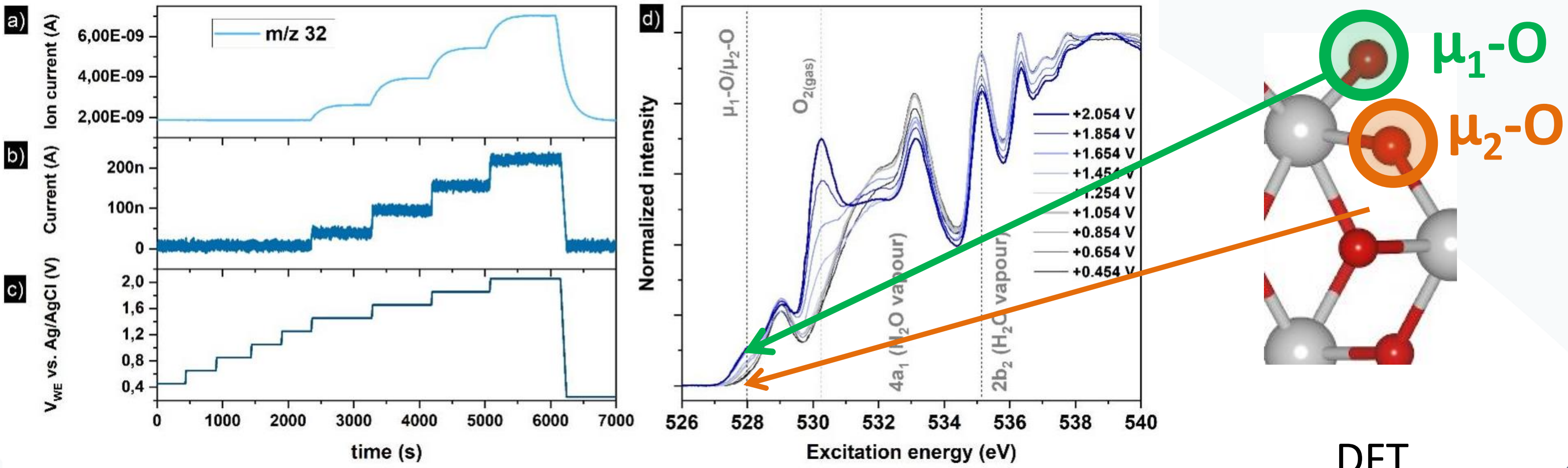

DFT calculations

Advanced Energy Materials (In press) DOI: 10.1002/aenm.202303407

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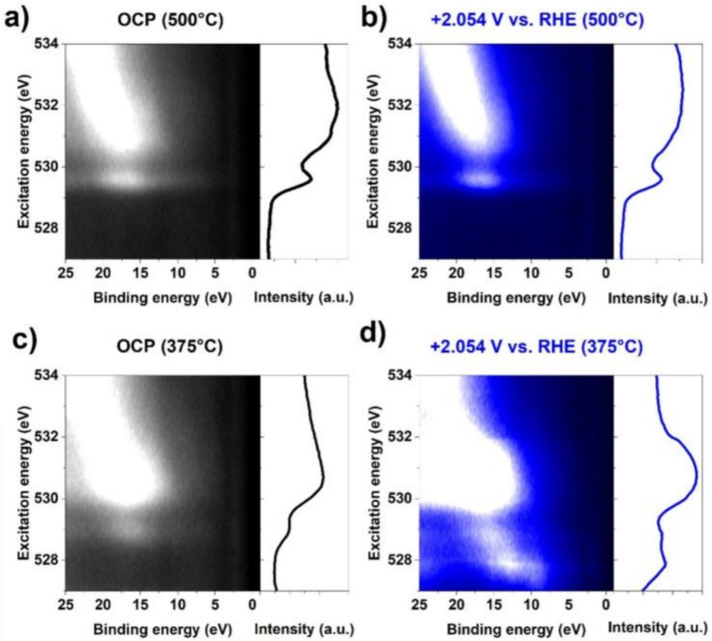

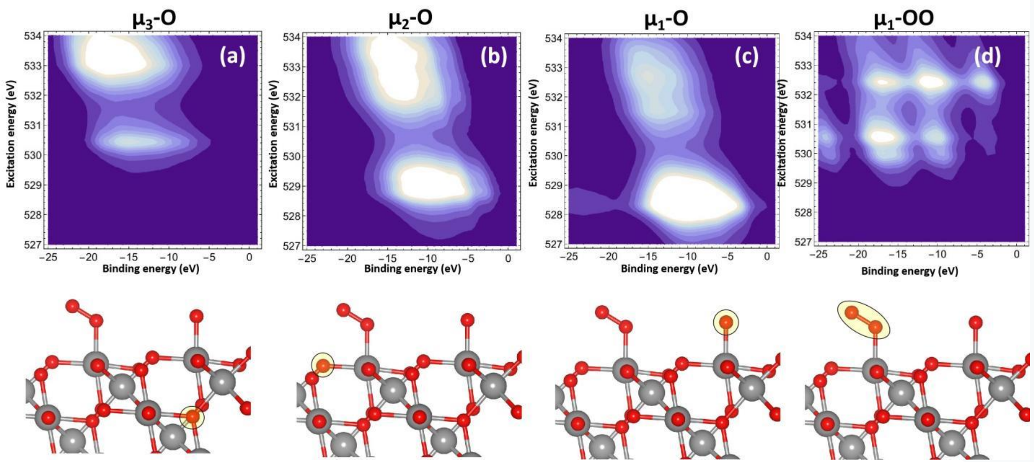

Dr. T. Jones (LANL)

Advanced Energy Materials (In press) DOI: 10.1002/aenm.202303407

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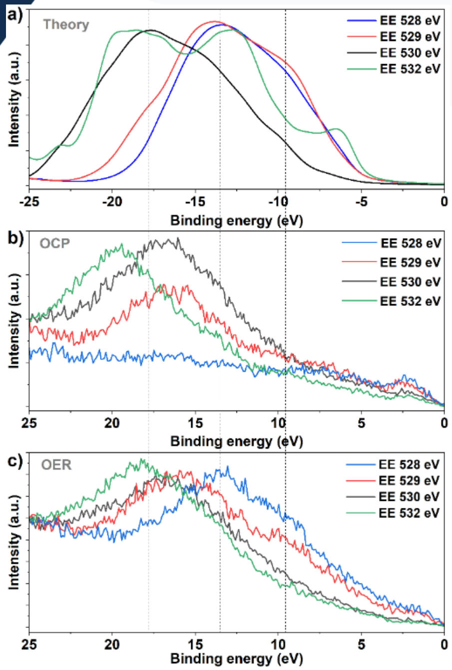
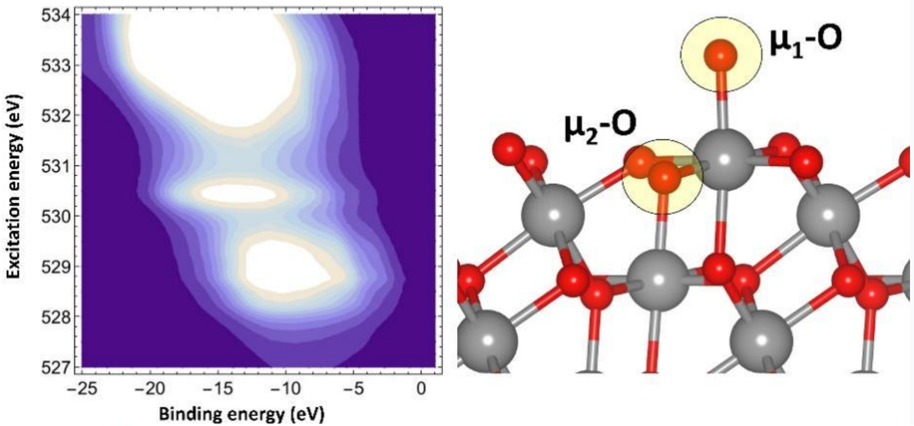
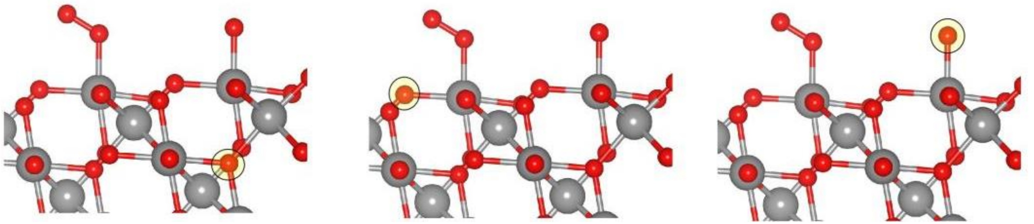


a) Calculated resonant Auger spectra of oxygen species on the (110) and (111) surfaces of rutile-type IrO_2. The computed EE of the various species are *ca*. 530 eV for the μ_3-O and μ_2-OH, 529 eV for the μ_2-O and μ_1-OH, 528 eV for the μ_1-O, and 532 eV for the μ_1-OOH and μ_1-OO. Measured spectra under **b)** OCP and **c)** OER conditions.

During OER





μ_3-O (stability)

μ_2-O (Surface electron hole)

μ_1-O (Surface active species)

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New beamline in ALBA synchrotron

3SBar will combine ambient pressure X-ray Photoemission Spectroscopy (AP-XPS) at high pressures(1 bar or more) and surface X-ray diffraction (SXRD) at grazing incidence angles. First beamline optimized for ALBA II.

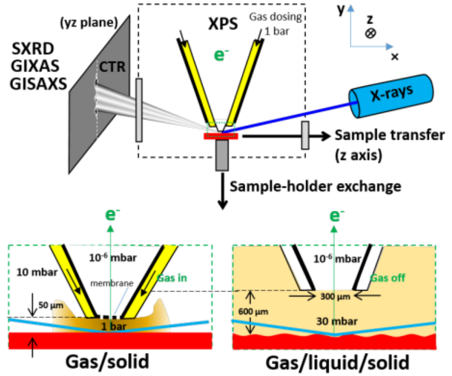
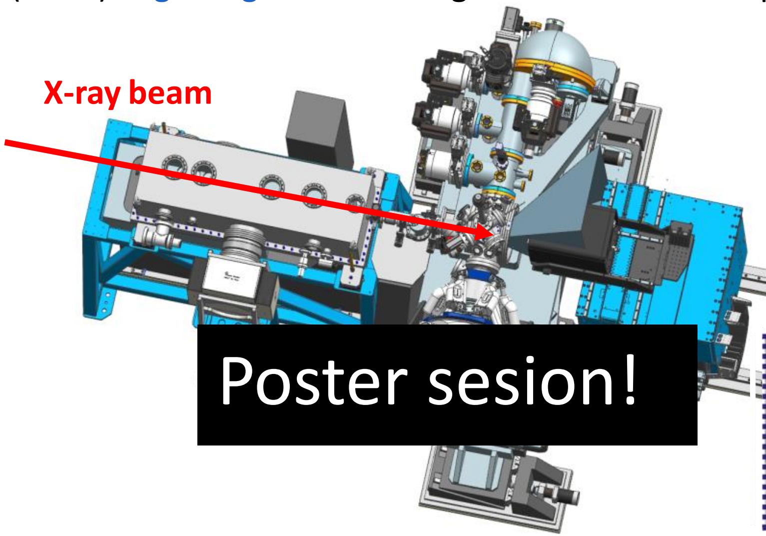
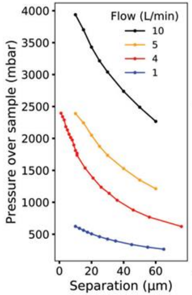


Fig. 1: a) Top-view description of the 3Sbar approach (see also Figs. 15-17). b) schematic zoom-in description of the sample/analyzer front-cone geometry for gas/solid and gas/liquid/solid experiments.

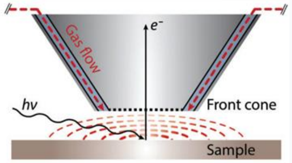
X-ray beam

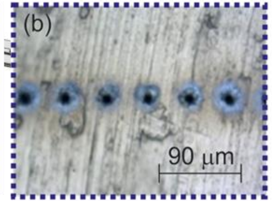


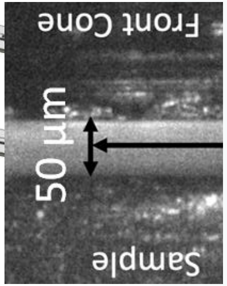
Poster sesion!



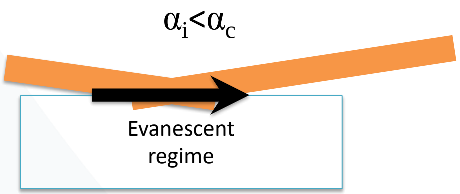
BL15







In operation in 2026



Surface sensitivity

Total external reflection: X-ray depth control

Signal enhancement!

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Acknowledgments

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R. Mom

Yang Shao-Horn

A. Knop-Gericke

B. Roldan Cuenya

Robert Schlögl

3Sbar team

https://public.cells.es/jobs/#!/jobs/bl-scientist-3sbar-within-the-framework-of-the-recovery-transformation-and-resilience-plan

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