



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ORGANIZZATO DA



Bologna: un hub di ricerca per lo sviluppo
dell'idrogeno - 9 ottobre 2024

Decoupled production of solar fuels LEAF



Francesco Paolucci

Dipartimento di Chimica «Giacomo Ciamician»

BolognaFiere 9-11 ottobre

Decoupled production of solar fuels

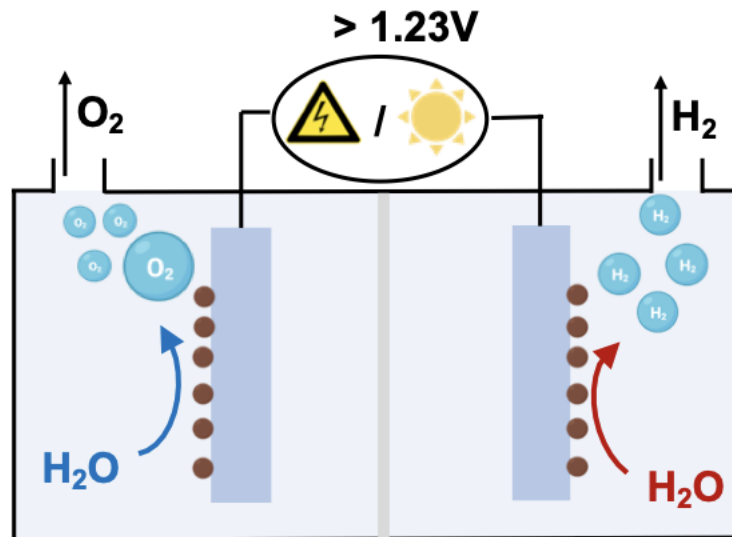
LEAF

The main objectives of the **LEAF project** are:

- (1) Realization of efficient and stable photoelectrodes made of earth-abundant materials
- (2) Selection of the best catalysts and redox mediators in terms of efficiency and stability
- (3) Realization of a device for hydrogen production by sun-driven water splitting with STH of 3%
- (4) Dissemination and communication

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conventional photoelectrochemical cell for direct water splitting

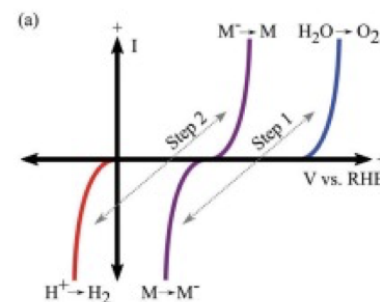
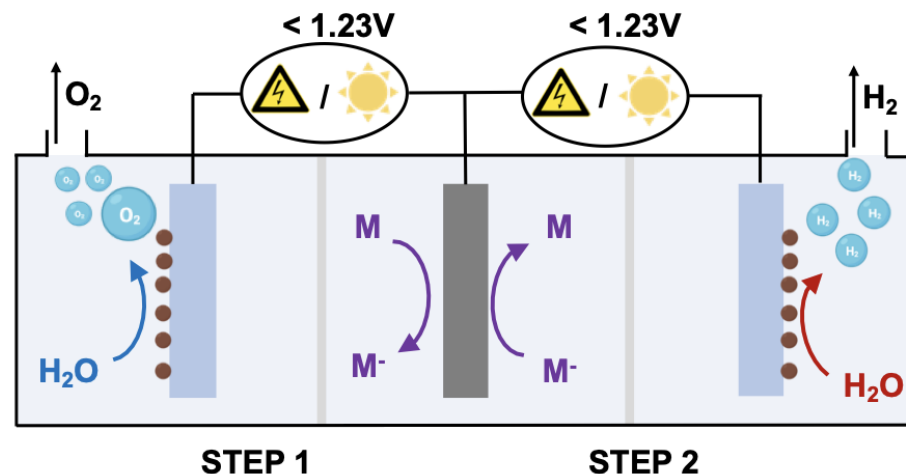
→ very high overpotential for OER

→ discontinuity

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Decoupled Water Splitting

TIPO A

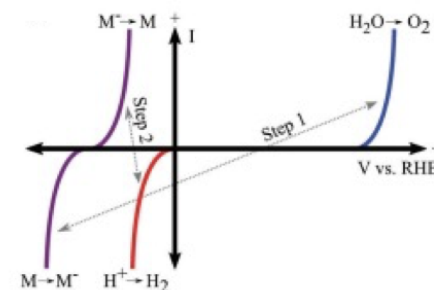
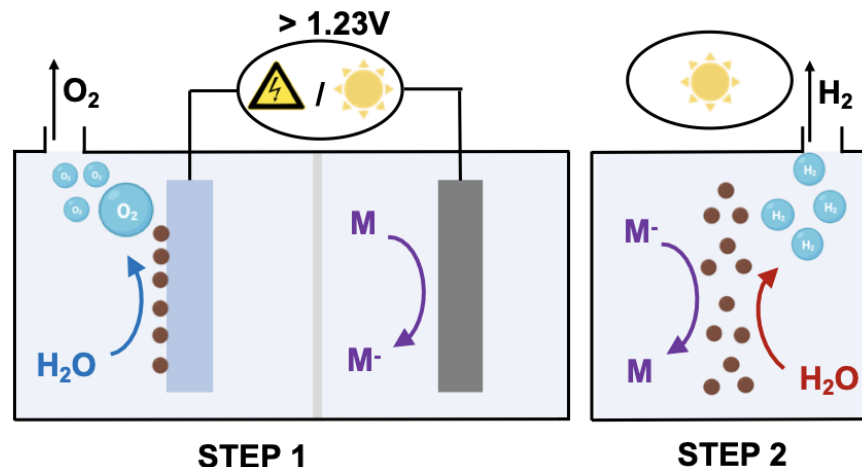


$$E^\circ(\text{H}^+/\text{H}_2) < E^\circ(\text{M}/\text{M}^+) < E^\circ(\text{O}_2/\text{H}_2\text{O})$$

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Decoupled Water Splitting

TIPO B



$$E^\circ(H^+/H_2) > E^\circ(M/M^-)$$

	leader	year 1						year 2					
		M1-2	M3-4	M5-6	M7-8	M9-10	M11-12	M13-14	M15-16	M17-18	M19-20	M21-22	M23-24
WP1: Photoanodes and (photo)cathodes	UNIFE												
T1.1: Photoanodes	UNIFE							D1.1					
T1.2: Water-oxidation catalysts	UNIFE							D1.1					
T1.3: (Photo)cathodes	UNICT					D1.2		D1.3					
								M1.1					
WP2: Characterisation of the materials	UNICT												
T2.1: Structural characterisation	UNICT						D2.1						
T2.2: (Photo)electrochemical characterisation	UNIBO/UNIFE										D2.2		
											M2.1		
WP3: Decoupled production of H₂	UNIBO												
T3.1: Redox mediators of type A	UNIBO						D3.1						
T3.2: Redox mediator of type B	UNIBO						D3.1						
T3.3: Catalyst for H ₂ production	UNICT								D3.2				
									M3.1				
WP4: Photoelectrochemical cells	UNIFE												
T4.1: PEC of type A	UNIBO										D4.1		
T4.2: PEC of type B	UNIFE										D4.1		
T4.3: Optimization of the device	UNIFE												D4.2
													M4.1
WP5: Communication and dissemination	UNICT												
T5.1: Project webpage	all partners		D5.1										
T5.2: Dissemination	all partners												D5.2
T5.3: Outreach activities	all partners												D5.2
													M5.1
WP6: Management	UNIBO												
T6.1: Scheduled reports and meetings	all partners	D6.1											D6.2
													M6.1

Decoupled production of solar fuels

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WP1: PHOTOANODES AND (PHOTO)CATHODES (UNIFE, UNICT)

Task 1.1: Photoanodes (UNIFE)

Task 1.2: Water-oxidation catalysts (UNIFE)

Task 1.3: (Photo)cathodes (UNICT)

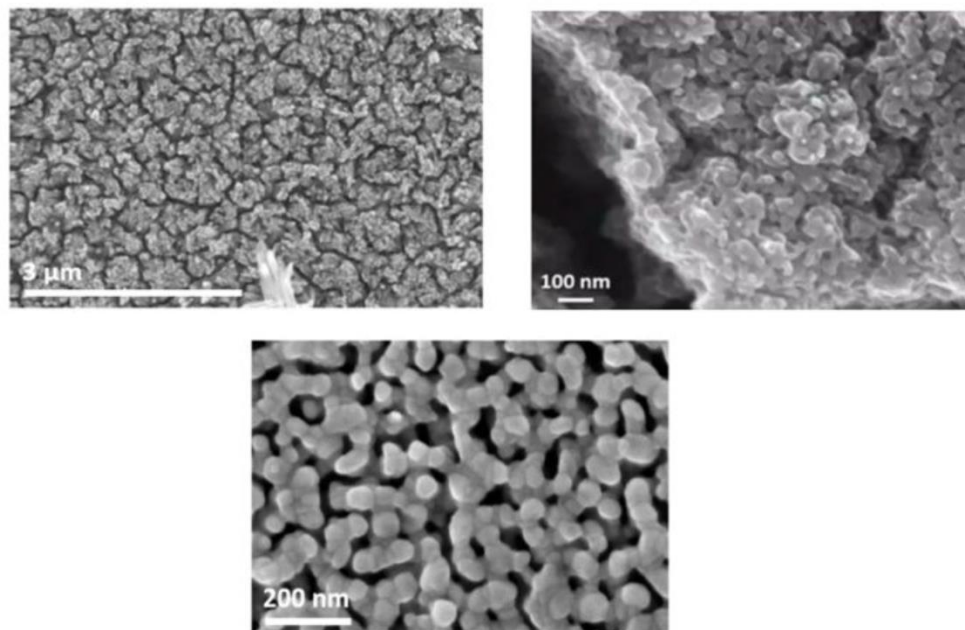


Figure 3. Images of hematite (top) and $\text{WO}_3/\text{BiVO}_4$ photoanodic materials (bottom) produced by UNIFE.

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WP1: PHOTOANODES AND (PHOTO)CATHODES (UNIFE, UNICT)

Task 1.1: Photoanodes (UNIFE)

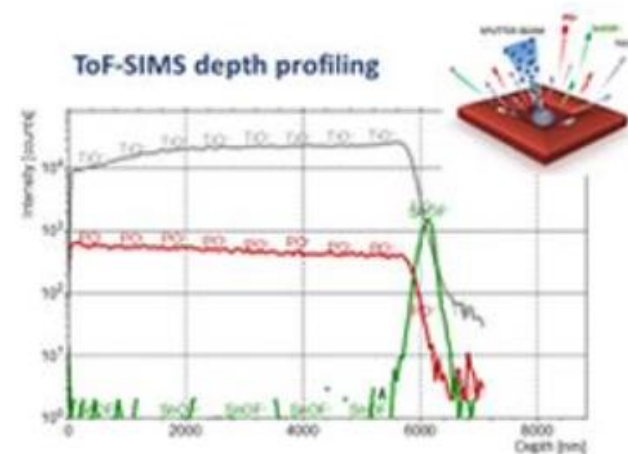
Task 1.2: Water-oxidation catalysts (UNIFE)

Task 1.3: (Photo)cathodes (UNICT)

WP2: CHARACTERISATION OF THE MATERIALS (UNICT, UNIBO, UNIFE)

Task 2.1: Structural characterization (UNICT)

Task 2.2: (Photo)electrochemical characterization (UNIBO, UNIFE)



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WP1: PHOTOANODES AND (PHOTO)CATHODES (UNIFE, UNICT)

Task 1.1: Photoanodes (UNIFE)

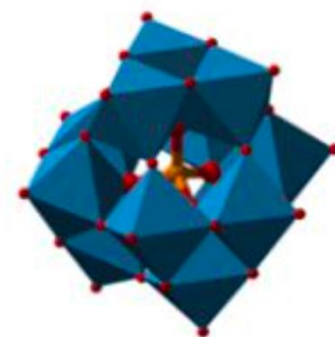
Task 1.2: Water-oxidation catalysts (UNIFE)

Task 1.3: (Photo)cathodes (UNICT)

WP2: CHARACTERISATION OF THE MATERIALS (UNICT, UNIBO, UNIFE)

Task 2.1: Structural characterization (UNICT)

Task 2.2: (Photo)electrochemical characterization (UNIBO, UNIFE)



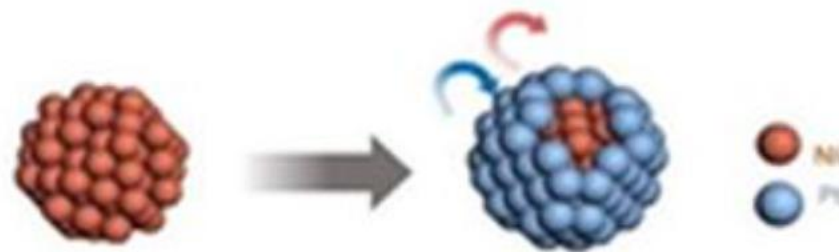
Polyoxometallate

WP3: DECOUPLED PRODUCTION OF H₂ (UNIBO, UNICT)

Task 3.1: Redox mediators of type A (UNIBO)

Task 3.2: Redox mediators of type B (UNIBO)

Task 3.3: Catalyst for H₂ production (UNICT)



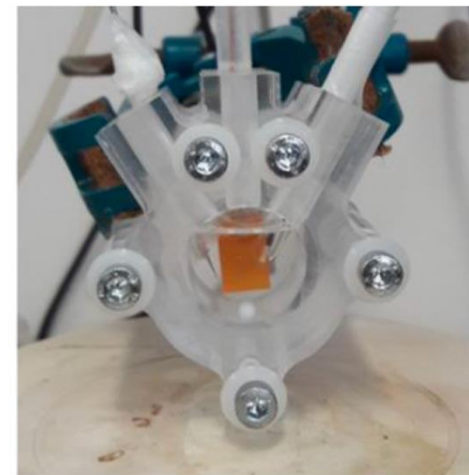
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WP4: PHOTOELECTROCHEMICAL CELLS (UNIFE, UNIBO)

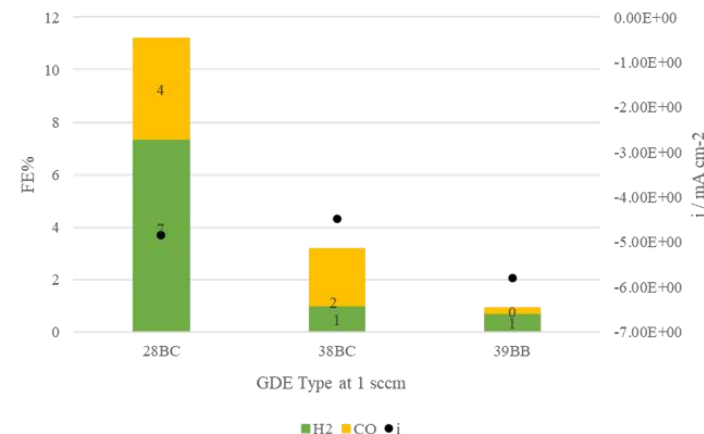
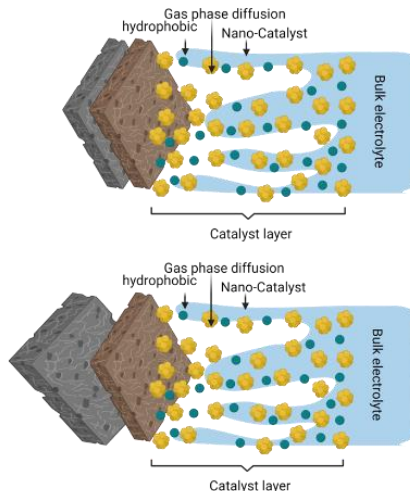
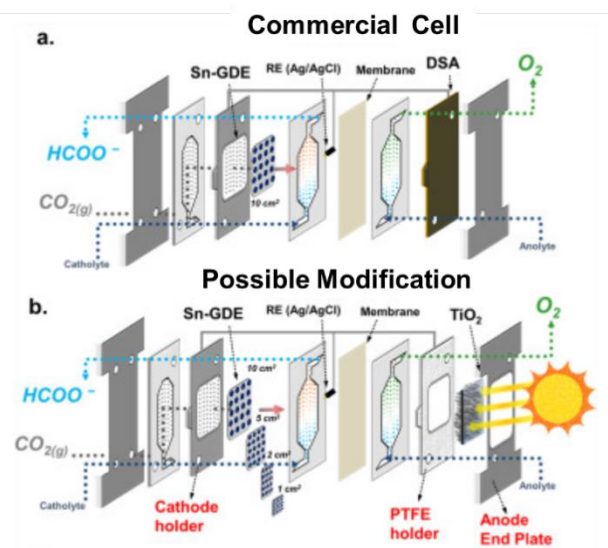
Task 4.1: Photoelectrochemical cell of type A (UNIBO)

Task 4.2: Photoelectrochemical cell of type B (UNIFE)

Task 4.3: Optimization of the device (UNIFE)



PEC cell with hematite photoanode



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Credits:

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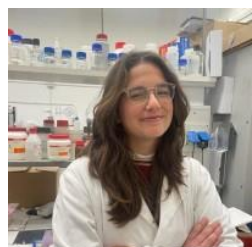
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