

# BALIPA

## Batterie Lithium-ion à charge Photo-Assistée

Fannie Alloin, Jean-Claude Leprêtre, Frédéric Sauvage

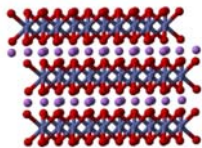
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29 janvier 2018



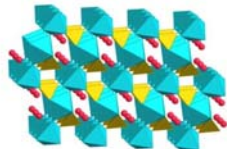
# I. INTRODUCTION - Energy storage

## Inorganic materials

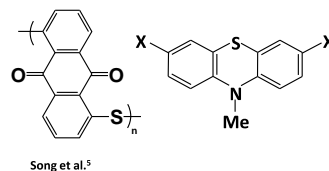
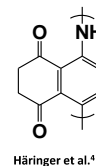
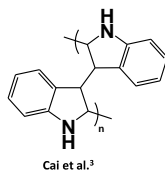
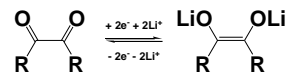
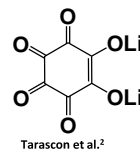
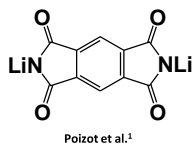
LiCoO<sub>2</sub>



LiFePO<sub>4</sub>



## Organic materials

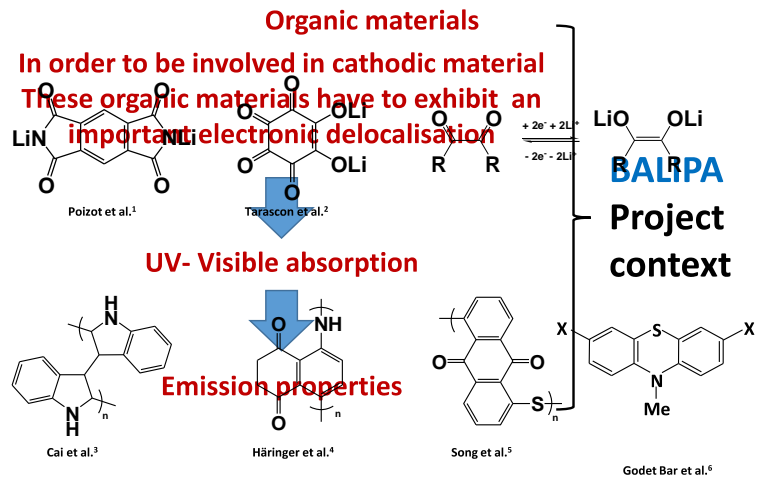


Godet Bar et al.<sup>6</sup>

<sup>1</sup>P. Poizot et al., *Energy & Environmental Science* 4 (2011) 2003-2019 / <sup>2</sup>M. Tarascon et al., *J. Am. Chem. Soc.* 131 (2009) 8984-8988  
<sup>3</sup>Z. Cai et al., *Synthetic Metals* 160 (2010) 1902-1905 / <sup>4</sup>D. Häringer et al., *Journal of The Electrochemical Society* 146 (1999) 2393-2396  
<sup>5</sup>Z. Song et al., *Chemical Communications* (2009) 448-450, <sup>6</sup>T. Godet-Baret al *PCCP* (2015), 17(38), 25283-25296.



I. INTRODUCTION -



Deals  
with the association of both  
Electrochemical  
And  
Photochemical  
properties

In view to benefit the light absorption  
to charge the battery with **lower energy**

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Project

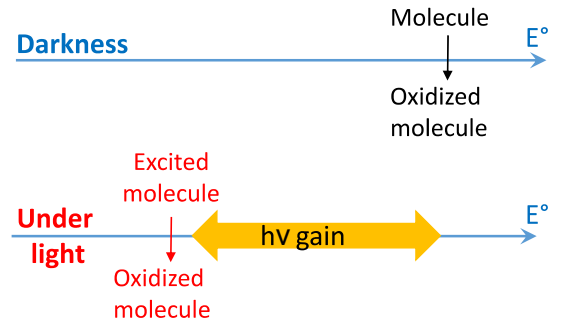
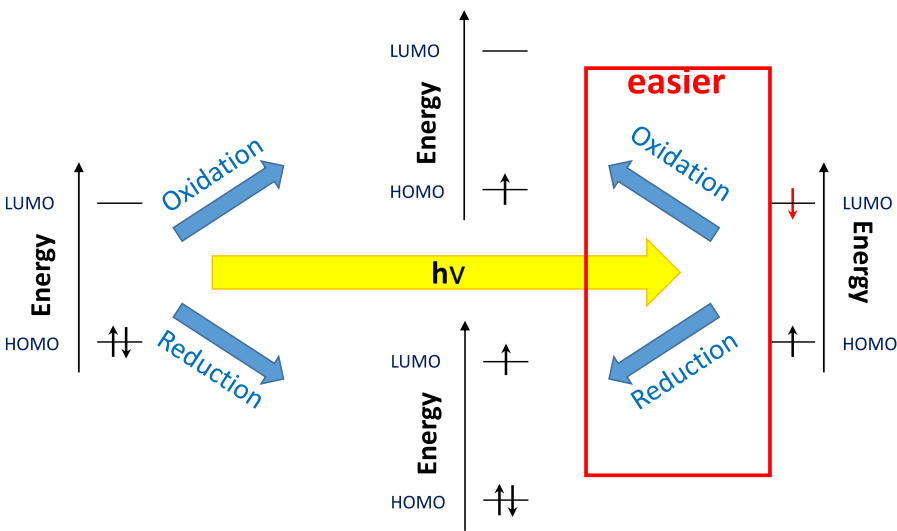
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II. PRINCIPLE -

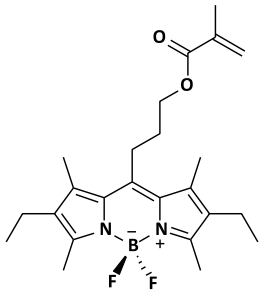


**DECREASE OF THERMODYNAMIC POTENTIAL by exciting the photo-sensitive molecule**

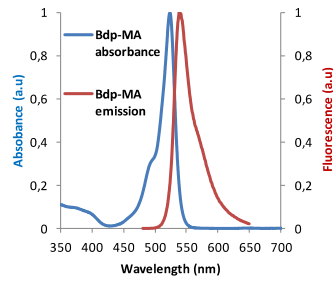
**Battery with high electrical yield :  
E discharge >>> E charge**



### III. TARGET -



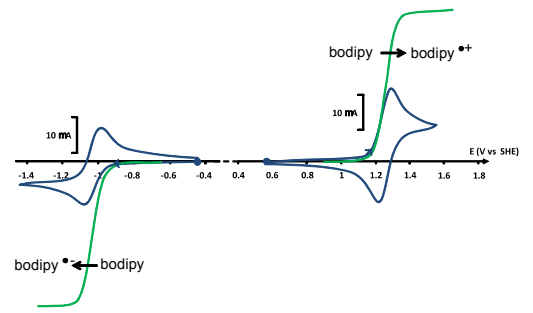
**Bodipy derivatives**



Asorption/Emission in Dichloroethane

**Photochemistry**

- Visible absorption
- High quantum yield
- Good excited state lifetime

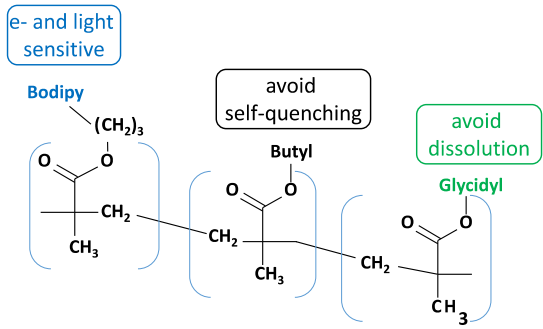


**Electrochemistry**

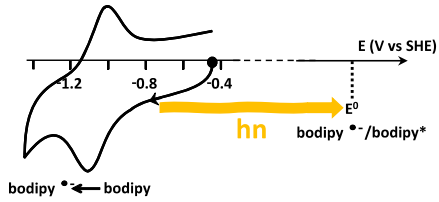
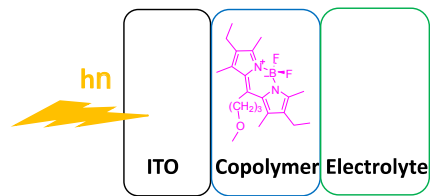
- Reversible processes (Red, Ox)
- Fast redox systems



### Use of Copolymer



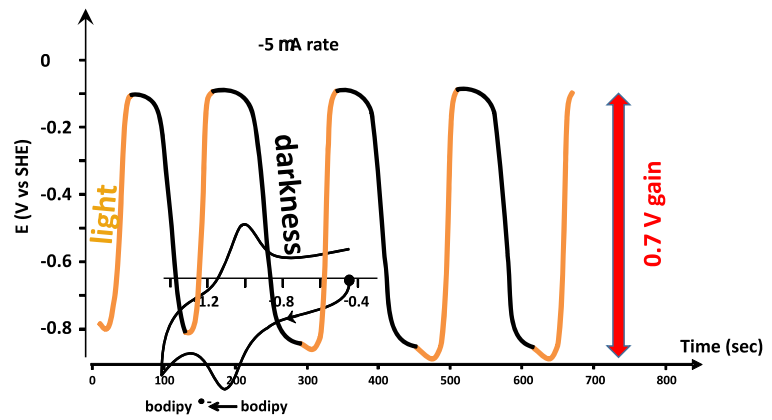
Copoly (Bodipy/butyl/glycidyl)



Electrochemistry on ITO

Theoretically close to 2 V gain





*J. Mater. Chem. A*, 2017,5, 1902-1905

**But :** electrical yield is low (70%) due to the too low stability of both bodipy and the polymeric matrix



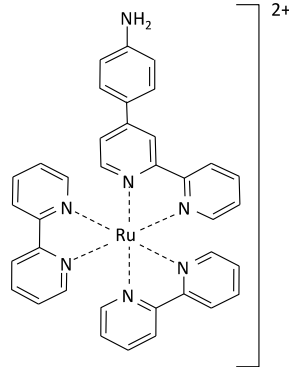
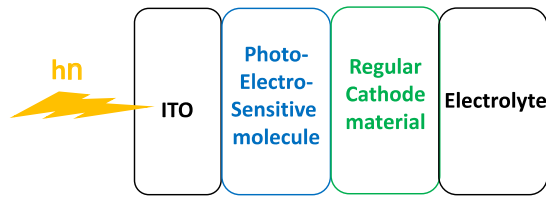
#### IV. NEW TARGET – in progress

Proof of concept



The stability of the photo-electro -sensitive molecule has to be improved

The photo-electro -sensitive molecule has to be involved in a photo-electro catalytic process

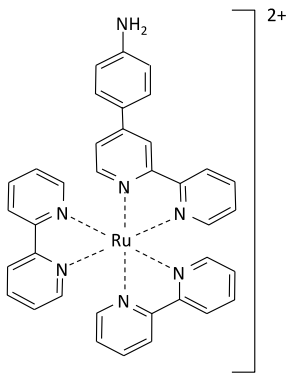


**The ruthenium complex provides**

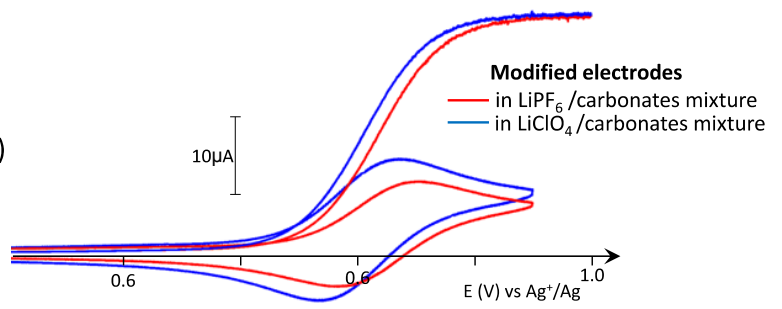
- an increase chemical stability
- an easier chemical fonctionnalisation ( diazonium)
- a  $E^\circ$  modulation ( ligand)



### III. NEW TARGET – in progress



Electro-grafting (nitrite)  
  
 Cyclic voltammetry



**Stable modified electrode**  
**Tunable tickness ( number of cycles)**

Sensitive towards the electrolyte ( paper in prep)



#### IV. NEW TARGET –perspectives



18 months post doc

Pursuit of the study involving the Ru<sup>II</sup> complex and LFP

REU programm hosting one student from the Binghamton University  
Collaboration with Pr Wayne E. Jones (dept of chemistry)





**Merci de  
votre  
attention**



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