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### ► To cite this version:

M Mockbel, L Schmidt, B Meddas, K Chaouchi, S Blanchandin, et al.. Comparative study of hematite-based photoanodes using operando STXM and Raman spectroscopy -Methods and First results. XVI-IIth GFB conference - GFB Winter School, Jan 2025, Autrans, France. . hal-04906175

**HAL Id: hal-04906175**

**<https://hal.science/hal-04906175v1>**

Submitted on 22 Jan 2025

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# Comparative study of hematite-based photoanodes using operando STXM and Raman spectroscopy - Methods and First results

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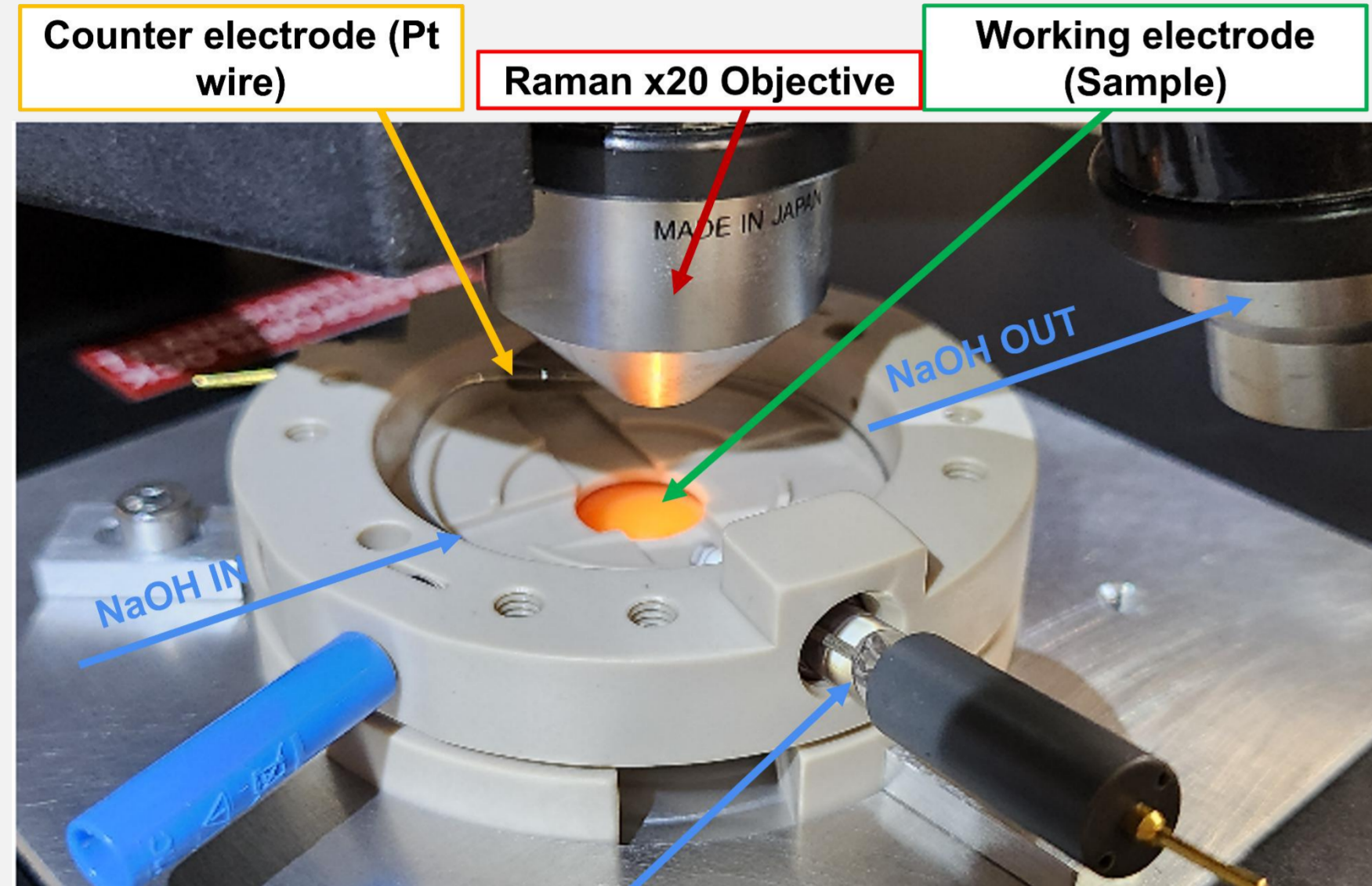
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## INTRODUCTION

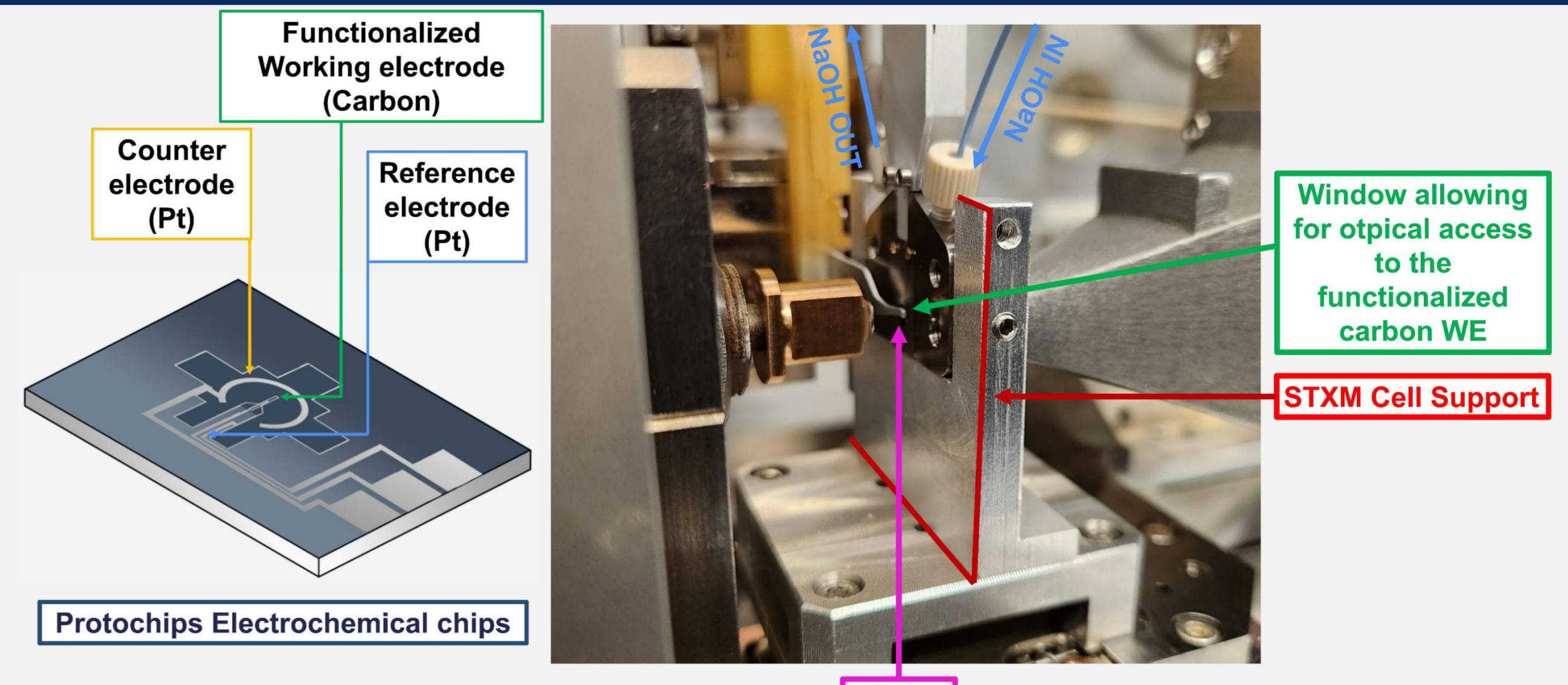
Improving photoelectrochemical (PEC) performances of the hematite-based photoanodes for the oxygen evolution reaction (OER) can be achieved by using Ni(OH)<sub>x</sub> as a co-catalyst. However, the precise role of Ni-O<sub>x</sub>H<sub>y</sub> during the OER remains poorly understood. To better understand the co-catalyst role, we need to perform operando experiments, i.e. probing the materials changes during operation. We show here preliminary results combining Raman and STXM in operando conditions at key electrochemical potentials.

### RAMAN



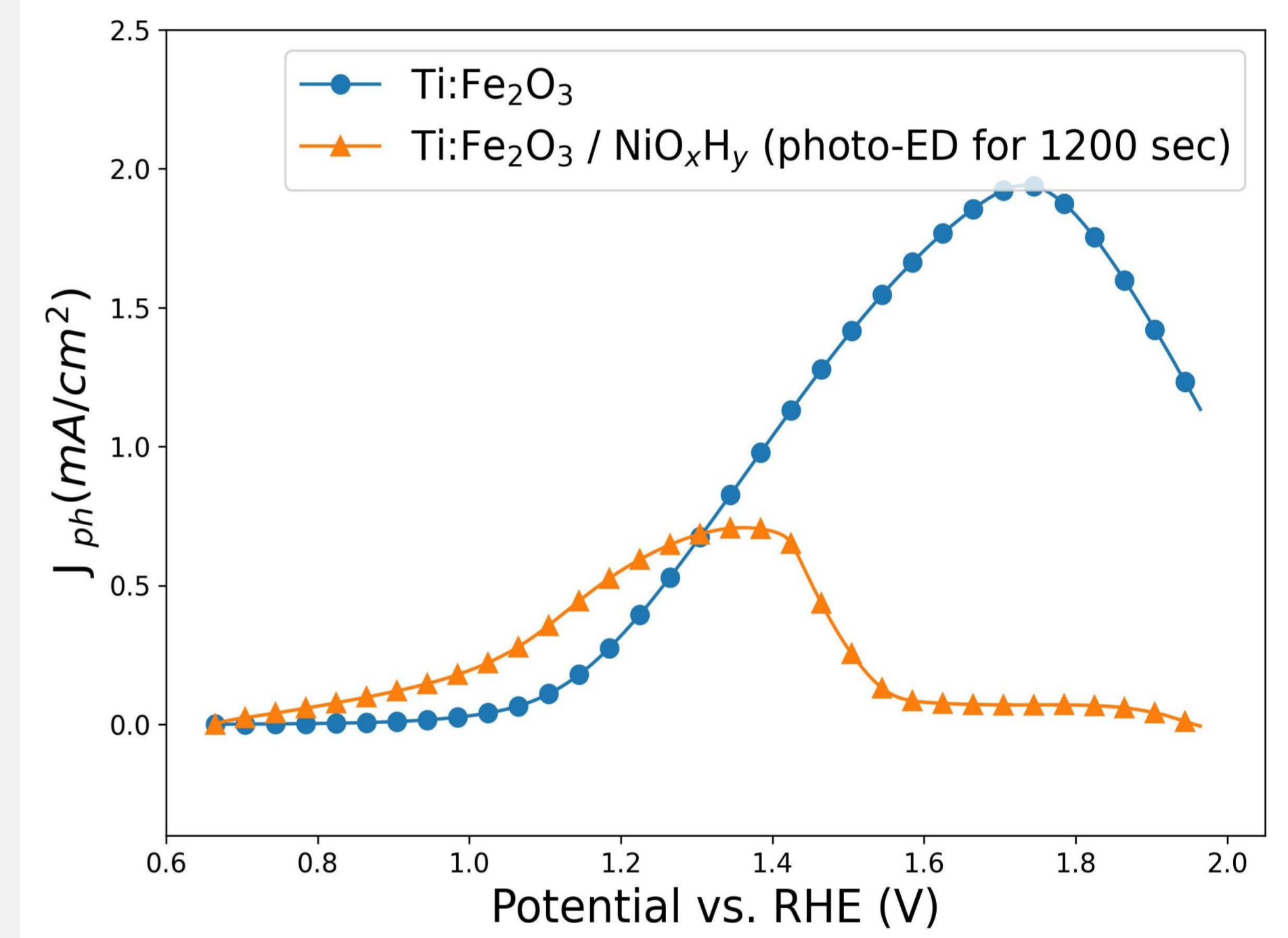
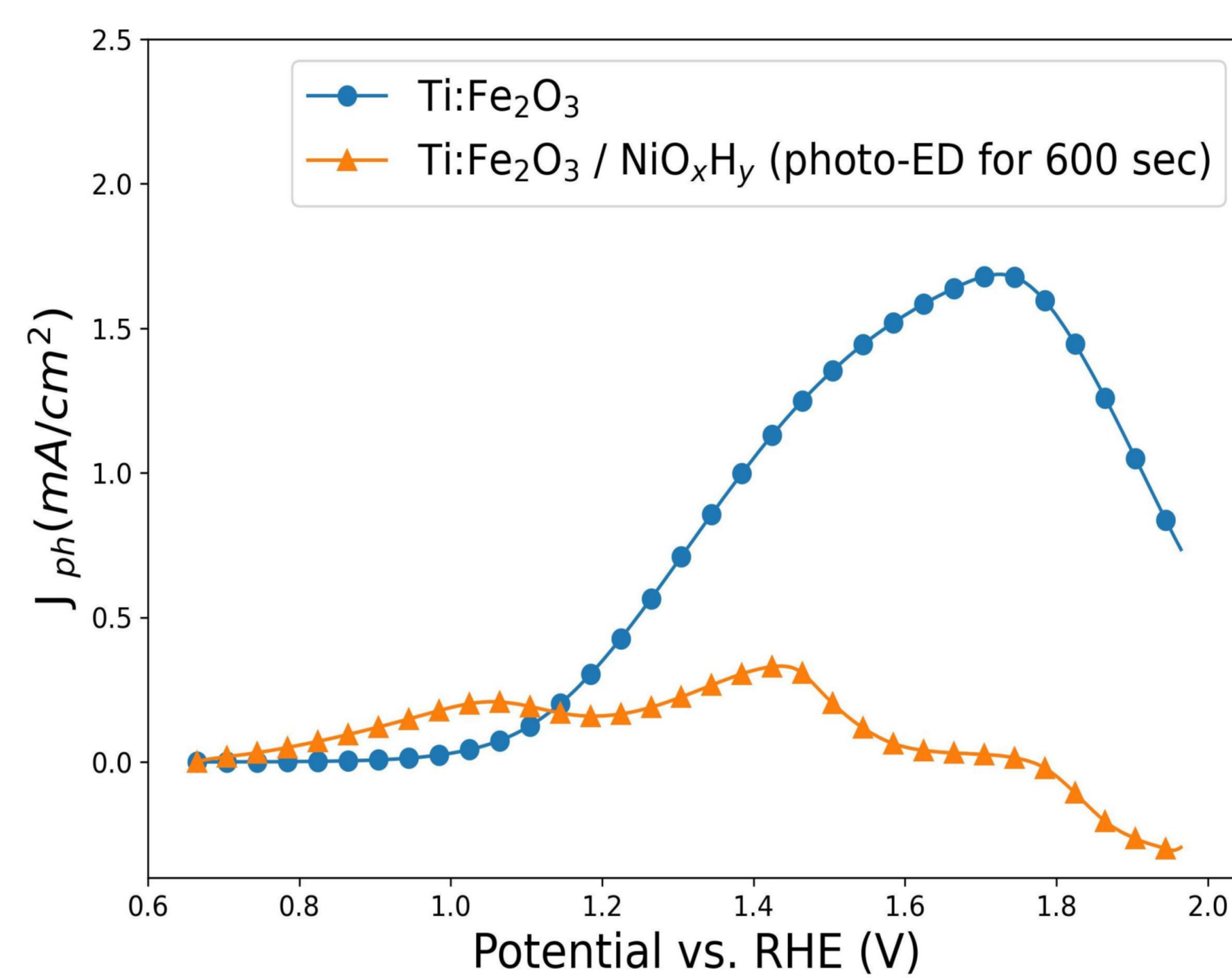
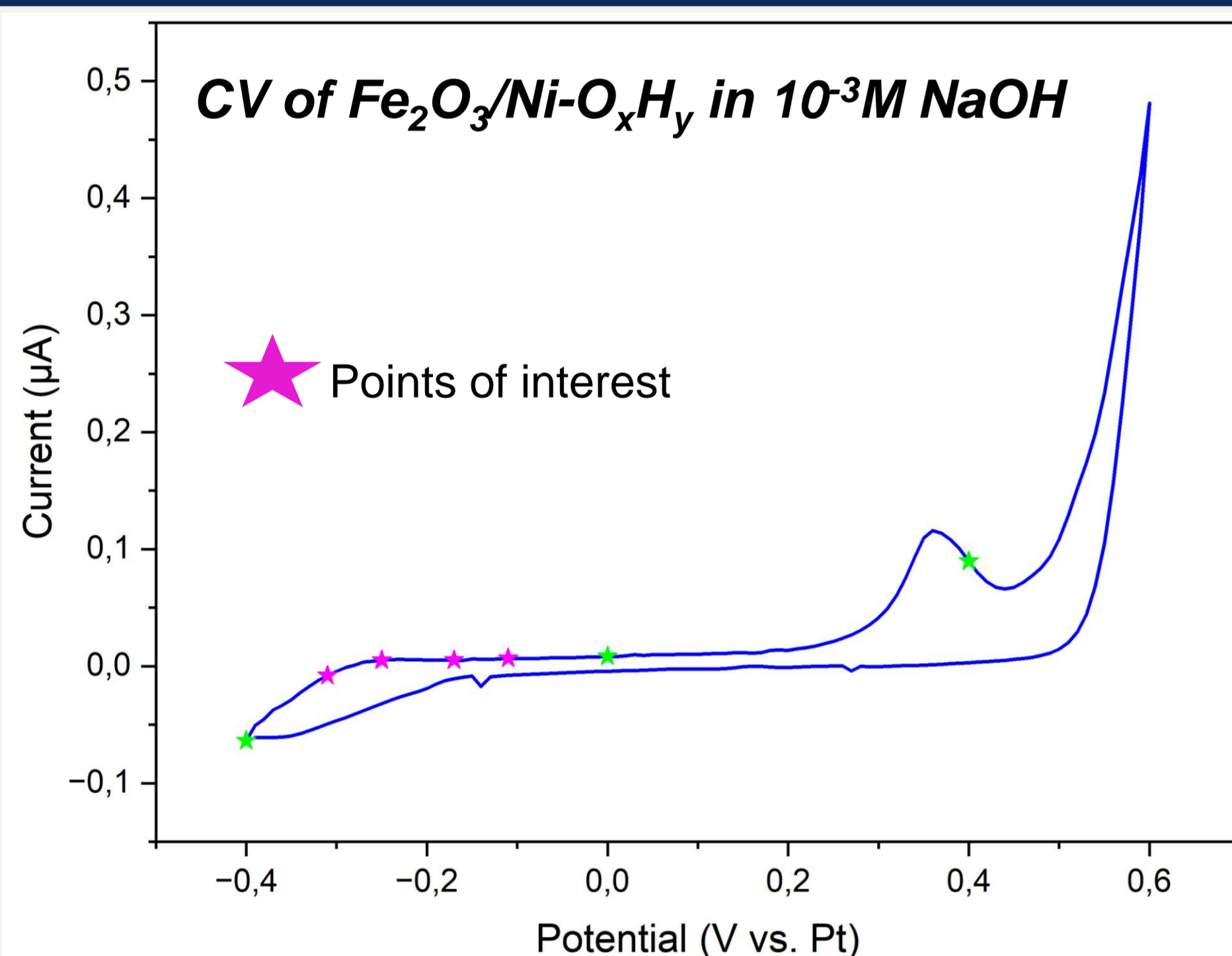
Raman Operando Set-up

### STXM



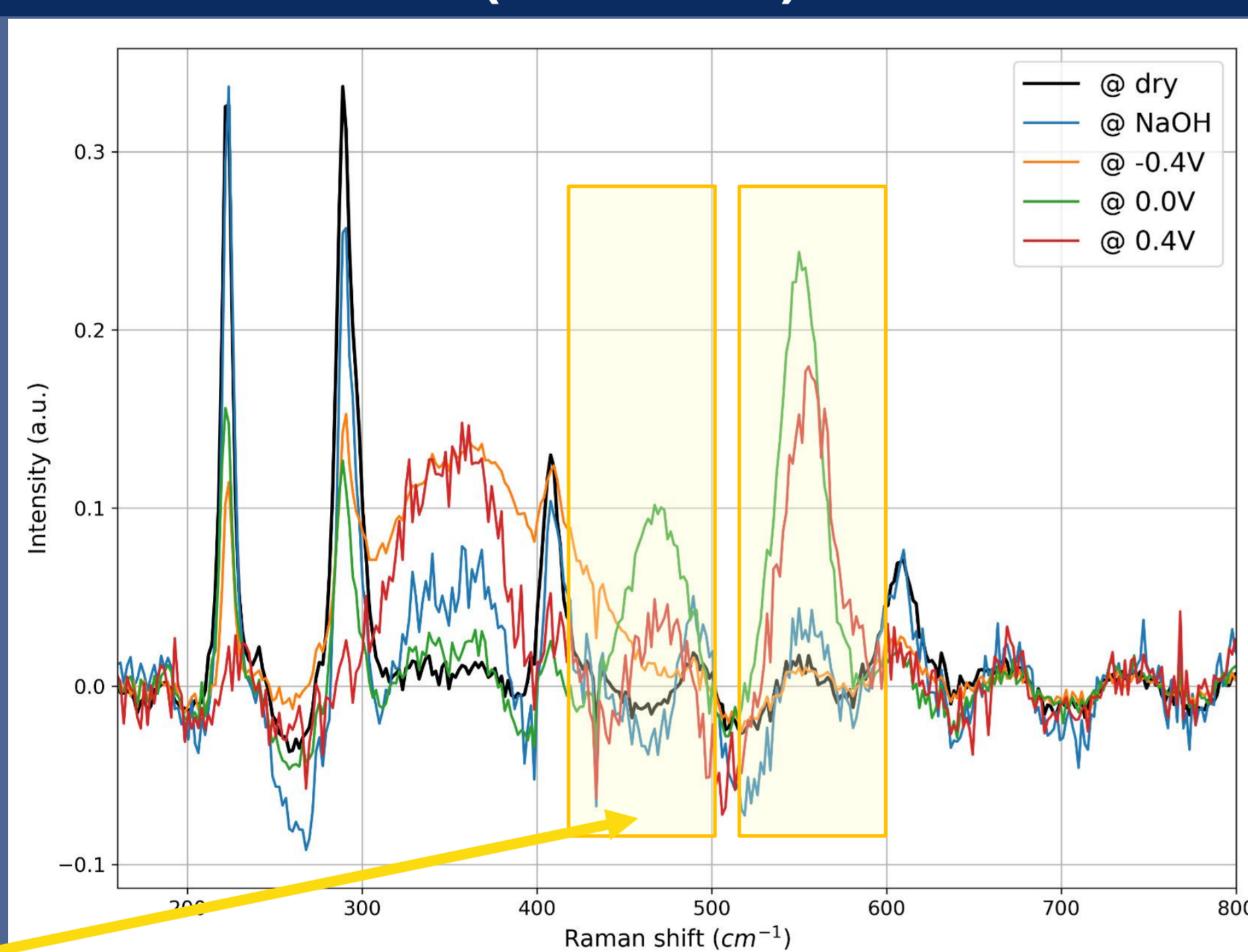
STXM Operando Set-up

## Macroscopic and microscopic (photo-)electrochemical methods

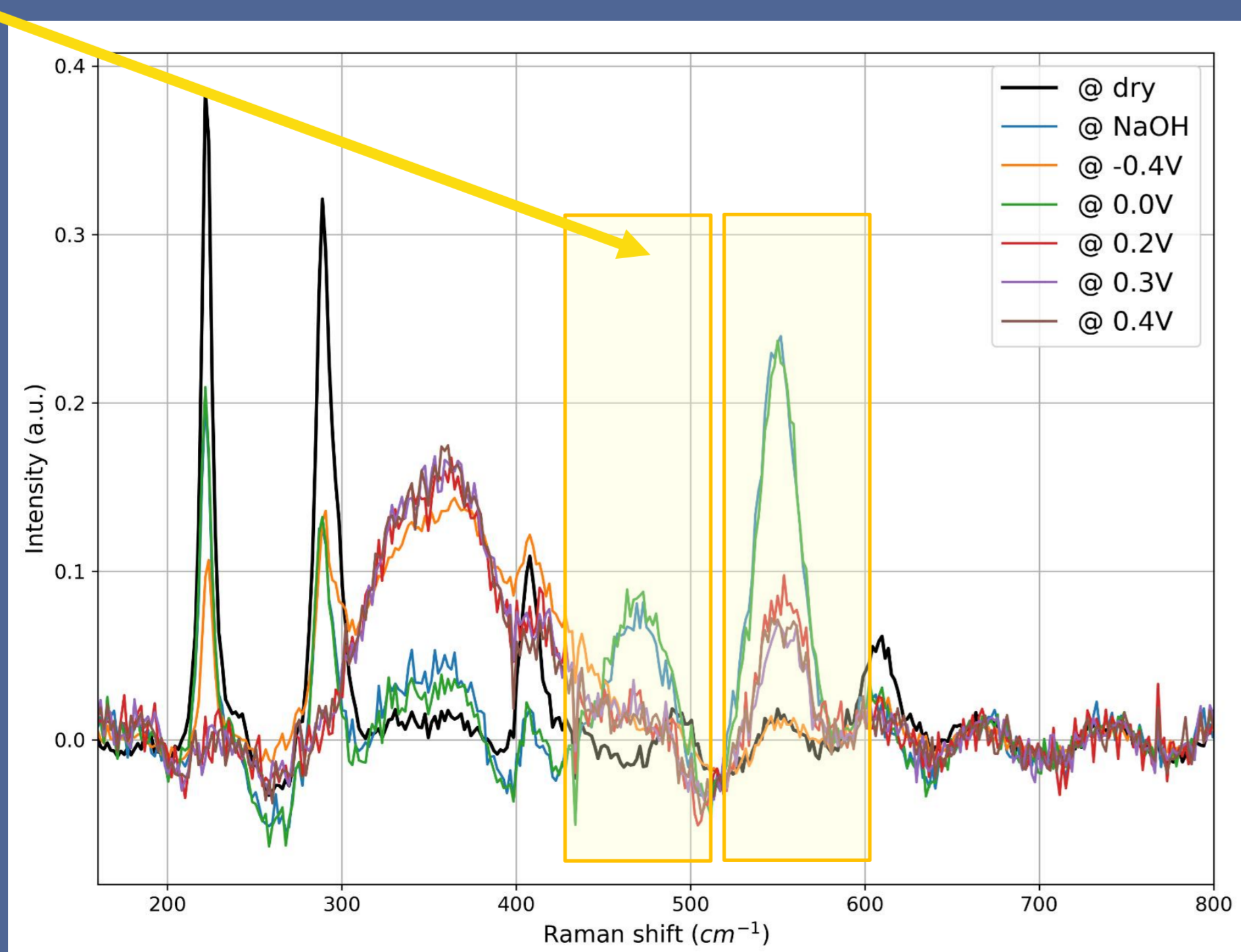


## FIRST RESULTS

### Raman (@ 785nm)

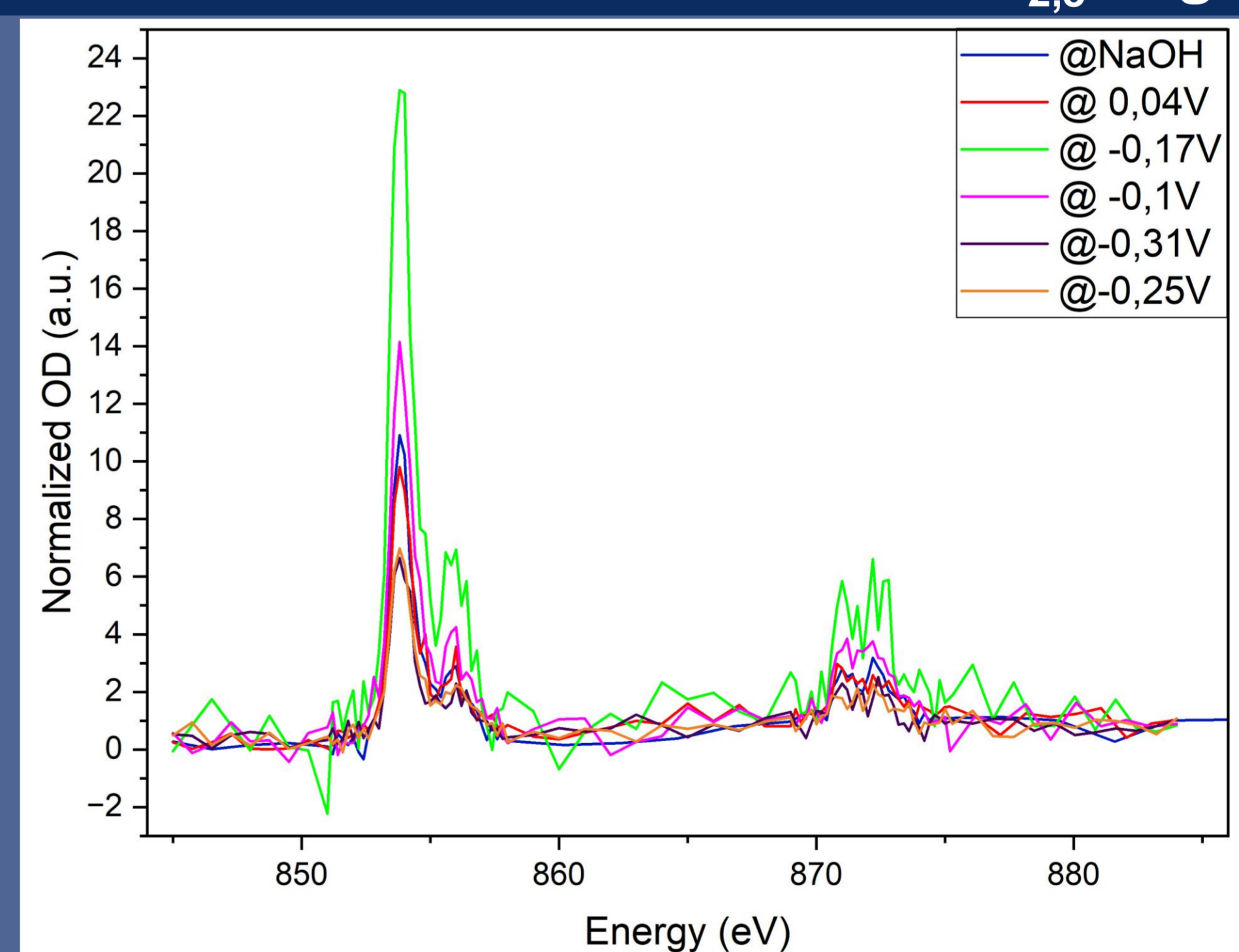


*Fe<sub>2</sub>O<sub>3</sub>/Ni-O<sub>x</sub>H<sub>y</sub>  
pED for 600sec*

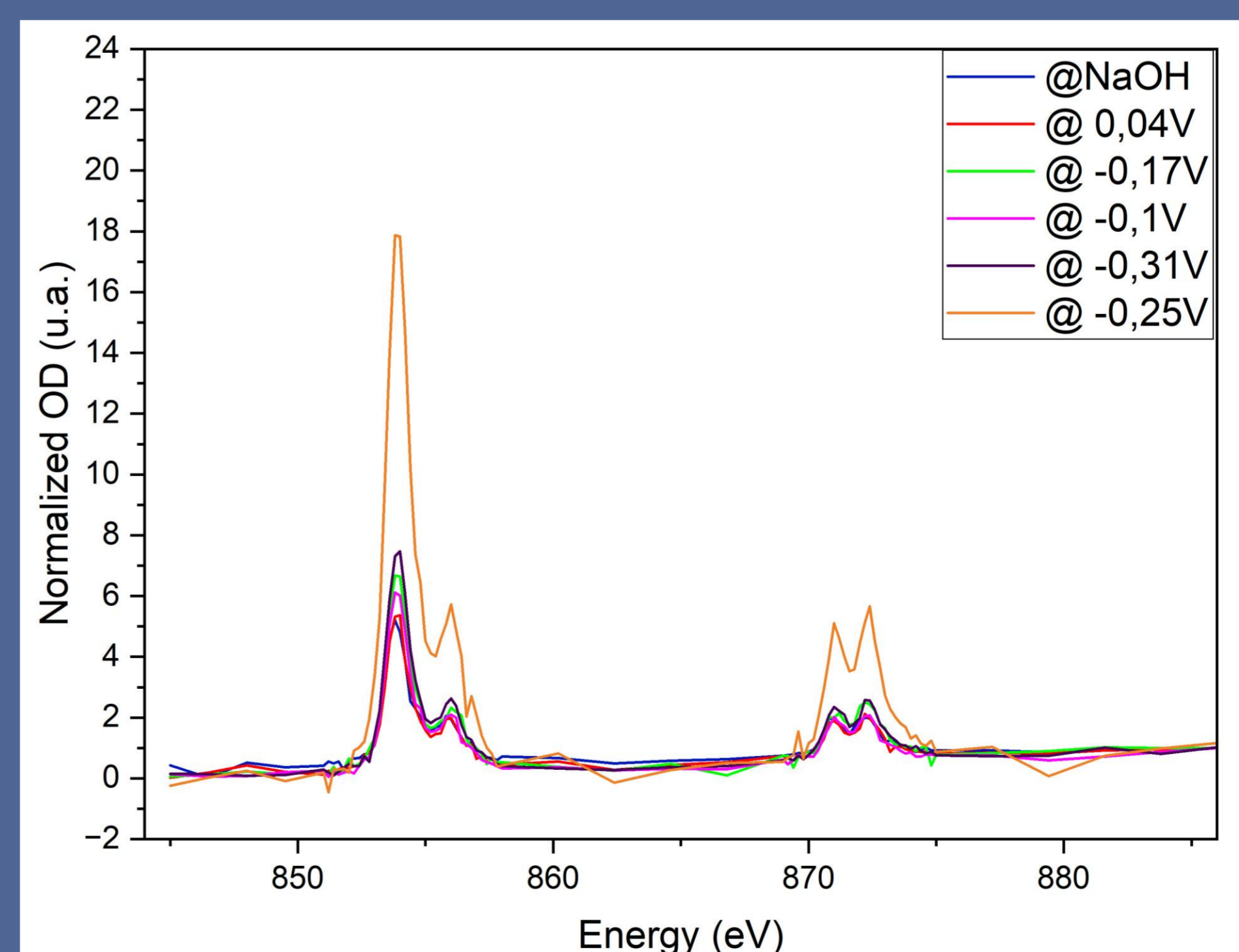


*Fe<sub>2</sub>O<sub>3</sub>/Ni-O<sub>x</sub>H<sub>y</sub>  
pED for 1200sec*

### STXM : XANES @ Ni L<sub>2,3</sub> edge



Ni L<sub>2,3</sub> edge



## CONCLUSION

These first results demonstrate the feasibility of Raman and STXM in operando conditions. Both approaches are very sensitive to the electrochemical conditions and allow to get valuable information concerning the chemistry and the chemical coordination at the semiconductor/electrolyte interface.