From Ex Situ to Operando Soft X-rays Microscopy of Photoactive Materials: Case of Hematite-based Photoanodes

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ABSTRACT

We will present here a journey in the soft X-rays microscopy world, using mainly XANES as contrast mechanism, following several recent developments allowing today to track chemistry and chemical coordination evolution in operando conditions, at nanoscale.

Over the last few years, we successfully applied soft X-rays microscopies, STXM [1-3], spectro-ptychography and XPEEM [4], to characterize hematite-based photoanodes dedicated to solar assisted water splitting. Prototypical photoanode material with perfectly matched band gap for efficient solar light absorption, chip, abundant, and ecofriendly, hematite offers a perfect sandbox for band engineering approaches, as Ti doping or Oxygen vacancy control. We will first present an overview of the results obtained in ex situ conditions, both from STXM and XPEEM perspective, emphasizing the need for operando approaches as unique way to tackle the mechanisms at the origin of charge transfer at the photoanode/electrolyte interface. In the second part we will address the in situ and operando methodology, under development, along with some preliminary results demonstrating the feasibility of our approach.

REFERENCES

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