PhD Topic at LRCS, Amiens, FRANCE https://www.lrcs.u-picardie.fr/	
Topic Title	**Development of 3D and 4D imaging by X-ray synchrotron tomography for the morphological and kinetics studies of new generation Li-S and Li-air batteries**
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Collaborations	APS and ESRF synchrotron
Funding Source, Name of project	French Minister PhD Thesis
Web Site of Advisor (if applicable)	http://modeling-electrochemistry.com/ http://ademortiere.weebly.com/
Publication date of the offer	May 8th, 2017
Deadline for application	June 1st, 2017
Date of start of the Project	October 1st, 2017
Description of the Topic	This PhD thesis will focus on methodological and instrumental development. The multi-scale aspect of this technique with the coupling of µ-CT (0.5µm) and nano-CT (20nm) is crucial because it gives access to 2 different scales in the electrode architecture, thus linking mesoscopic phenomena (wetting and diffusion in the porosity) and micrometric (carbon contact / Li_2O_2 or Li_2S reaction product) to the evolution of the electrochemical properties and the electrode design methods. **(1)** The first step will be 3D analysis coupling the µ-CT and nano-CT modes. Ex situ analyzes at different regimes and number of cycles will be carried out by following the evolution of the morphological properties (volume, fracture, contact) and their surrounding environments in the composite electrode. **(2)** Next, electrochemical in situ measurements will be made from this same sample using the tomographic cell in order to follow in real time the electrochemical processes. An optimization of *in situ* experimental conditions should be found for each systems. **(3)** The work of reconstruction and segmentation will be done from programs written under Python via Tomopy

	and FIJI. The 3D analyzes of the objects thus obtained will be carried out using the software Geodict and Avizo. **(4)** Electrochemical simulations will be carried out with Python and Matlab codes already available in the laboratory and will support the interpretation of the experimental results.
Techniques to be used	✓ TXM tomography ✓ Characterization of Li-S and Li-air battery ✓ In situ electrochemical experiments ✓ 3D and 4D imaging ✓ Morphological and kinetics studies
Skills of the Applicant	Master in Materials Science or in condensed matter, good knowledge of imaging technique and programming will be appreciated.
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List of documents to provide	CV + motivation letter + list of references