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| **PhD at LRCS, Amiens, FRANCE**<br>**https://www.lrcs.u-picardie.fr/** | |
| **Topic Title** | *New lamellar materials as negative electrodes for Li, Na & K ions batteries* |
| **Principal Advisor** | Seznec Vincent, vincent.seznec@u-picardie.fr, 0322825331 |
| **Co-advisor** | Monconduit Laure, laure.monconduit@umontpellier.fr, 04 67 14 33 35 |
| **Collaborations** | Elodie Salager (NMR – Orléans), Leanic Madec (XPS – Pau) |
| **Funding Source, Name of project** | CNRS – RS2E |
| **Web Site of Advisor** | |
| **Date of publication of the offer** | May 21st, 2019 |
| **Deadline for application** | July 1st, 2019 |
| **Date of start of the Project** | October 1st, 2019 |
| **Description of the Topic** | Silicon is the key anode material for Li-ion and possibly sodium batteries with theoretical capacities of 3590 mAh / g for $Li_{15}Si_4$ and 954 mAh / g for NaSi. Nevertheless, there are well-known locks such as the volume expansion (310% during the insertion of Li) or the low electronic conductivity resulting from limited kinetics and insertion of Na. In order to respond to these limitations, we have recently explored Si-based structures with a two-dimensional structure, the siloxenes, to direct the reaction with alkalis (Li, Na, K) to a topotactic insertion mechanism, less penalizing in terms of the integrity of the electrode and beneficial for the cyclability. It will be expanded to Sn, Ge and mixte 2D materials. The insertion/deinsertion mechanism will be deeply studied.<br>L. C. Loaiza, L. Monconduit, V. Seznec, J. Power Sources, 417 (2019) 99-107, https://doi.org/10.1016/j.jpowsour.2019.02.030. |
| **Techniques to be used** | The candidate will have to respond to the above problems:<br>1. Synthesize new M-ene materials (based on Si, Sn, Ge, and mixed) by mechanical grinding and heat treatment then acid attack (R-MgBr, R-OH, R-$NH_2$) to obtain the lamellar compounds with flexible interfacial space and up to exfoliation.<br>2. Carry out the characterization of the initial materials by X-ray diffraction, thermal analyzes, IR, Raman, MET.<br>3. Prepare and optimize electrode formulations<br>4. Carry out electrochemical analyzes in Li, Na or K batteries (galvanostatic cycling, cyclic voltammetry, cycling behavior, polarization)<br>5. Identify the mechanisms involved using techniques such as X-ray diffraction (in and ex-situ), Raman (in and ex-situ), liquid and solid NMR (in and ex-situ), IR. |
| **Skills of the Applicant** | A Highly motivated candidate is looked for this PhD thesis. He/She must have or will obtain a Master diploma in Chemistry, Electrochemistry or Material Science. Knowledge in the field of batteries, battery materials as well as characterizations techniques such as IR, Raman, electrochemistry, XRD, microscopy will be appreciated. |
| **Contact (s)** | vincent.seznec@u-picardie.fr & laure.monconduit@univ-montp2.fr |
| **List of documents to provide** | CV + motivation letter + list of references **(send to the 2 contacts)** |