



SEMINAIRE IPCMS

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à 15h à l'auditorium

« Solid state chemistry, a source of innovations in the sodium-ion batteries' fields »

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Known from all chemists for decades, the sodium-ion battery technology was dethroned in the 1980s by the lithium-ion battery that offered better performance. The major interest of sodium is to be a sustainable resource in comparison to lithium. The technology is thus back on the scene as an ecological, economical and reliable alternative to the lithium-ion battery. I will present the challenges of this research field, and highlight some of our results. I will show how we were able to (i) discover a new family of NASICON structural type materials $\text{Na}_x\text{V}_2(\text{PO}_4)_3$, and (ii) demonstrate how the chemistry of mixed anions and in particular the competition between the ionic bond V-F and the very covalent vanadyle-type bond V=O has an impact on the properties of $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_{3-y}\text{O}_y$. I will demonstrate that only the in-depth control of the relationship synthesis/composition/atomic and electronic structure allows to tune the properties in the battery.

I will illustrate also that monitoring *in situ* and *operando*, especially at large scale facilities, the synthesis of electrode materials and their evolution when used in batteries is essential. Changes in the composition and structure of the materials must be studied in their environment (*in situ*), and in real time (*operando*) during their preparation or operation of the battery because they are most often in conditions out of equilibrium. The experiments thus conducted allow to study the dynamics of reactions, essential for the understanding of the material and optimization of its performance in the electrochemical storage system.