Iridium-based oxides as model compounds to study the redox properties of anions in cathode materials for Li-ion batteries.

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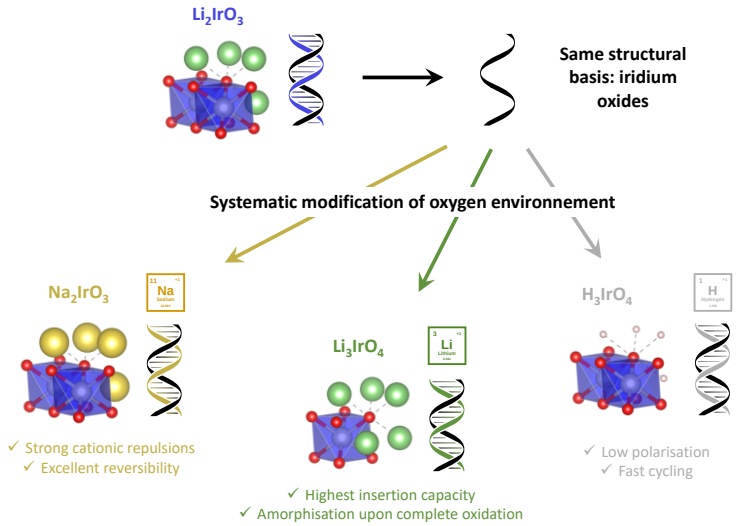
Improving energy storage stands as a key challenge to facilitate the transition to electric vehicles and renewable energy sources in the next years. In this context, a new generation of cathode materials for Li-ion batteries has been developed which benefits from the combined redox activities of transition metals (cationic redox) and of the oxygen ligands (anionic redox), resulting in enhanced capacities. However, activation of anionic redox in these high capacity materials comes with several issues that need to be solved prior their implementation in the energy storage market. Deep fundamental understanding of anionic redox is therefore required to go forward.

In this work, model systems based on iridium oxides were used to study how the redox activity of oxygen is influenced by its local environment. The electrochemical properties of the Na_2IrO_3 phase were studied to understand the impact of the alkali nature.[1] The influence of the Li/M ratio in rocksalt oxides was investigated with the synthesis of a new material Li_3IrO_4,[2] which presents the highest reversible capacity among intercalation cathode materials. Finally, the rich electrochemical properties of this family of iridate materials were extended by preparing proton-based materials through a simple ion-exchange reaction and the high rate electrochemical properties of a new $H_{3+x}IrO_4$ material are presented.[3]



Exploration of electrochemical energy storage properties of various iridium oxides depending on the local environment of oxygen.

Short biography:

After studying chemistry at Chimie ParisTech and UPMC, I joined the Laboratoire de Chimie du Solide et Energie at Collège de France to carry out a PhD on the energy storage properties of iridium oxides. I then moved to the University of Liverpool as a postdoctoral research associate where I study the physical properties of materials with unconventional anion oxidation states.

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[1] Perez A. et al. *Chem. Mater.* **2016,** *28, 22,* 8278-8288

[2] Perez A. et al. *Nature Energy*, **2017,** *2,* 954-962

[3] Perez A. et al. *Adv. Energy Mater.* **2018,** *1702855*