

Advanced Materials for Electrodes in Na-ion batteries.

Professor Teófilo ROJO

¹ Departamento de Química Inorgánica. Facultad de Ciencia y Tecnología. UPV/EHU, P.O. Box 644, 48080, Bilbao, Spain. e-mail teo.rojo@ehu.es

² CIC energiGUNE, Parque Tecnológico de Álava, Albert Einstein 48, 01510, Miñano, Spain.
e-mail: trojo@cicenergigune.com

Energy storage possesses an important role in order to rationalize the use of both fossil and renewable energy sources. Scientists are looking for inexpensive and green energy storage systems. At CIC-Energigune we are working on electrochemical energy storage: batteries and supercapacitors. A brief description of the activity developed at CIC-Energigune and fundamentally on sodium-ion batteries will be presented.

The development of sodium ion batteries is moving at a much faster rate and its use in the market is expected to be in near future. Very promising results have been reported in the recent past showing the performances of the sodium ion batteries very competitive for stationary energy storage [1, 2].

Energy density values of 210 Wh/kg can be obtained by using some specific electrode materials with an average cell potential of 3.3 V. A great range of compounds is being studied as possible cathode materials for Na-ion batteries, from oxides $\text{Na}_x[\text{Fe}_{1/2}\text{Mn}_{1/2}]\text{O}_2$ to phosphates NaFePO_4 , fluorophosphates $\text{Na}_3\text{V}_2\text{O}_{2x}(\text{PO}_4)_2\text{F}_{3-2x}$ (where $0 \leq x \leq 1$). Regarding the negative electrode, unlike the lithium ion batteries, the inability of sodium to insert into graphite is promoting the use of hard carbons, titanates and sodium alloys composites as anode materials.

In this talk we will present a general overview of the most interesting materials for electrodes in Na-ion batteries and the relationship between the structure and the electrochemical properties of these compounds.

References:

- [1] V. Palomares, P. Serras, I. Villaluenga, K. B. Hueso, J. Carretero-González, T. Rojo. *Na-ion batteries, recent advances and present challenges to become low cost energy storage systems*. Energy Environ. Sci. 2012, 5, 5884-5901.
- [2] V. Palomares, M. Casas-Cabanas, E. Castillo-Martinez, Man H. Han, T. Rojo. *Update on Na-Based Battery Materials. A Growing Research Path*. Energy Environ. Sci. 6,2312-2337(2013)