Preparation and Electrochemical Performance of Carbon Coated $Na_3(VO)_2(PO_4)_2F$

Paula Serras[a], Verónica Palomares[a], Pierre Kubiak[b], Luis Lezama[a] and Teófilo Rojo[a,b]

[a] *Departamento de Química Inorgánica, Universidad del País Vasco UPV/EHU, P.O. Box 644, 48080, Bilbao, Spain.*
[b] *CIC energiGUNE, Parque Tecnológico de Álava. A. Einstein 48, 01510 Miñano, Álava, Spain.*

There is a rising interest in the development of new energy storage technologies for low cost systems for grid storage. Sodium-ion batteries are considered as good candidates for medium and large-scale stationary energy storage, especially due to the increased interest in renewable energy sources that provide intermittent power which needs to be load leveled [1]. Among the possible cathode materials for these systems, sodium vanadium fluorophosphates $Na_3V_2O_{2x}(PO_4)_2F_{3-2x}$ have recently shown very good electrochemical performance *vs.* Na/Na^+ providing high working voltages and good specific capacity values [2]. To the best of our knowledge, $Na_3(VO)_2(PO_4)_2F$ (x =1) has been electrochemically studied in Na half-cell only by Sauvage et al.[3]. The authors reported a low capacity and attributed the poor electrochemical performance of this material to its low electronic conductivity. To circumvent these limitations it is often proposed to coat the active material with carbon. In this work we present the effect of carbon coating on the electrochemical performance of $Na_3(VO)_2(PO_4)_2F$.

$Na_3(VO)_2(PO_4)_2F$ has been successfully prepared by a novel single-step hydrothermal method. This material has been carbon coated using different conditions of thermal treatment. Structural characterization of the composites was performed by powder X-ray diffraction (XRD). The morphology of the materials was analyzed by Scanning Electron Microscopy (SEM) and the electrochemical measurements were conducted using Swagelok-type cells *versus* a metallic sodium anode.

Long thermal treatment leads to a partial decomposition of the $Na_3(VO)_2(PO_4)_2F$ material (**Fig.1**). But this structure is maintained if a flash thermal treatment is applied. Carbon coated $Na_3(VO)_2(PO_4)_2F$ exhibits higher rate performance than the raw material and excellent cycling stability (**Fig.2**). Further results about the preparation of the materials and their electrochemical properties will be exposed and discussed in the meeting.

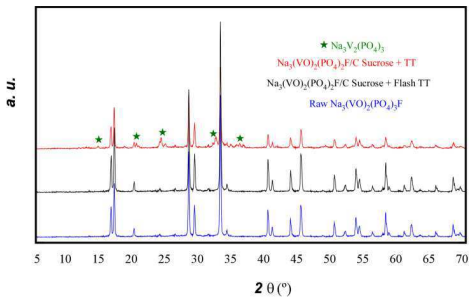

Figure 1. X-ray diffractograms of uncoated and carbon coated $Na_3(VO)_2(PO_4)_2F$ materials.

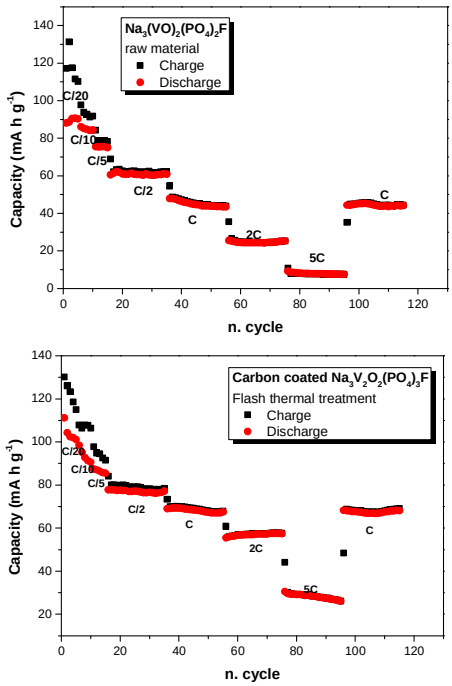

Figure 2. Rate capabilities of raw (top) and carbon coated (bottom) $Na_3(VO)_2(PO_4)_2F$ materials.

References

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Acknowledgments: This work was financially supported by the Ministerio de Educación y Ciencia (MAT2010-19442) and the Gobierno Vasco/Eusko Jaurlaritza (Etortek CICEnergigune 10, SAIOTEK-12 ENERGIBA and IT570-13).

Contact: pkubiak@cicenergigune.com