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Vanadium-free oxide glasses: Interesting positive electrode materials for Li-ion and Na-ion Technologies

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New materials are required to improve Li-ion and Na-ion batteries performances. Glasses are interesting as active positive electrodes materials. As well as being easy to process and produce on an industrial scale, glasses vitreous structure can undergo the structural changes required for alkaline insertion/disinsertion mechanisms. So far, mostly vanadium-containing glass positive electrodes were relatively well studied, reaching up to 1000 Wh/kg at the material level, for Li-ion cells [1].

Nevertheless, as Vanadium is considered by European Union as a critical raw material, Vanadium-free glasses need therefore to be investigated. Such glasses remain poorly reported in the literature as positive electrode materials, reaching around 60 mAh/g for iron silicates glasses [2], and 119 mAh/g for iron borophosphates glasses [3] in Li-ion technology, or 115 mAh/g sodium iron phosphate glasses for Na-ion batteries [4].

The goal of our research work is to investigate new oxide glass compositions for Li-ion and Na-ion technologies positive electrodes, study their structures, and understand the electrochemical mechanisms, to develop new glasses with high specific performances. The present work presents new oxide glass compositions for Li-ion and Na-ion technologies. Glasses were selected for their theoretical specific capacities, and synthesized using melt quenching technique. Then, pristine glasses were characterized by X-Ray Diffraction (XRD), X-ray Florescence Spectroscopy (XRF) and Secondary Electron Microscopy (SEM) in order to confirm the absence of crystalline phases, the chemical composition and the chemical homogeneity, respectively. Galvanostatic cycling was also performed on Li-metal and Na-metal coin cells with glasses active materials to evaluate their electrochemical performances. *Post-mortem* characterizations such as XRD and SEM were also performed on electrodes after charge and discharge phase, to apprehend mechanisms occurring during the cycling.

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