New positive electrode materials for K-ions batteries

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Abstract
In the years to come, energy production will have to be based on more environmentally-friendly methods, such as renewable energies. However, the intermittent nature of these energies means that large-scale storage is needed. Among the various technologies available, K-ion batteries appear to be an ideal solution thanks to their unlimited potassium resources. In this context, we are interested in the synthesis and characterization of new positive electrode materials for K-ion batteries. Transition metal oxides, and more specifically the K-Mn-O system, attracted our attention because of the advantages offered by manganese in terms of non-toxicity, low cost and abundance. The study of the KxMnO4 materials with a 0D structure based on manganese tetrahedron has proven to be very interesting. We have demonstrated an excellent reversibility between the two phases K3MnO4 and K2MnO4 with a specific capacity of 100mAh/g at an average redox potential of 2.4V. Furthermore, we were able to obtain the pure K2Mn2O3 phase through an original azide synthesis. Despite its 3D structure, containing tunnels promising a good potassium ion diffusion, this material decomposes during oxidation under charge. Nevertheless, when this compound is combined with the classic KxMnO2 material, a reversible capacity of 100mAh/g at an average potential of 3.5V vs K+/K is obtained, thus opening a new avenue for the discovery of new cathode materials for K-ion batteries.