
Investigation of ABO₃ type perovskites as negative electrodes for high power lithium ion batteries

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Résumé

The broader development of the electric cars and automotive guided vehicles for tomorrow's mobility requires the emergence of new fast-charging negative electrode materials to replace graphite in Li-ion batteries^{1,2}. Design of tailored multicationic oxides using innovative approaches could be the key for providing new negative electrode materials that allow faster charging and discharging processes³. In this work, AgNbO₃ perovskite material has been synthesized by employing different routes namely solid state, sol-gel and polyacrylamide routes and studied as a negative electrode for high power lithium ion batteries. AgNbO₃ crystallizes in an orthorhombic perovskite structure (space group Pbcm) with distorted (BO₆) octahedra, similar to most perovskites. This binary oxide has been studied in material science as antiferroelectric and sensing material⁴. Due to all occupied crystallographic sites in AgNbO₃ structure, it is expected to intercalate only negligible Li⁺ cations. However, the highly sensitive Ag⁺ at A-site of perovskite lattice support the structure to perform surprisingly well in terms of capacity and its retention at high rates possibly due to voltage-driven exsolution of Ag nanoparticles and creation of cationic and anionic vacancies. In order to understand the underlying reaction mechanism of the material for Li⁺ storage, *in-situ* XRD experiments were performed to evidence structural changes occurring upon cycling. In addition, *Ex-situ* SEM observations were made to get further insights about the underlying processes. This study presents an alternative approach to tailor the electrode material by *in-situ* electrochemistry without sacrificing the pristine phase of the active electrode material with a possibility to use ABO₃ type perovskites for fast charging batteries.

References:

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