

γ' -V₂O₅ : a high voltage cathode material for lithium batteries

M. Safrany Renard, R. Baddour-Hadjean, D. Muller-Bouvet, J. P. Pereira-Ramos

*Institut de Chimie et des Matériaux Paris Est, ICMPE/GESMAT, UMR 7182
CNRS Université Paris Est Créteil, 2 rue Henri Dunant 94320 Thiais, France*

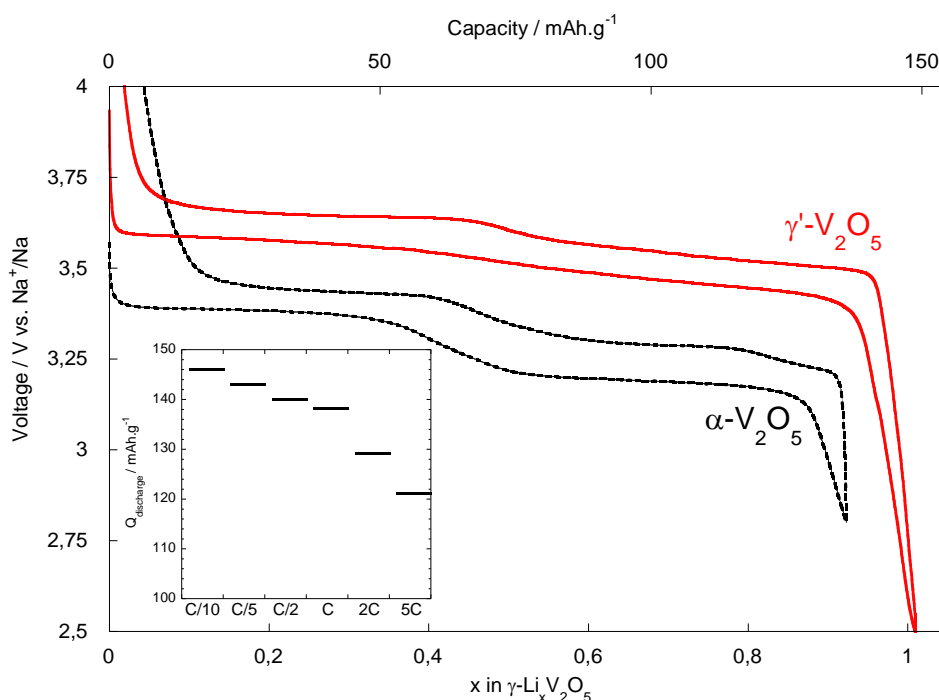
In this work, we focused on a lithium insertion compound: the γ' -V₂O₅ phase. This polymorphic phase of α -V₂O₅ was synthesized for the first time by Cocciantelli et al. [1]. In this study, γ' -V₂O₅ is the product of the γ -LiV₂O₅ total delithiation by chemical oxidation using NO₂BF₄. Its main interest in comparison with the α -V₂O₅ phase is to present a large interlayer space that can facilitate the alkali ions insertion.

We demonstrate that one lithium per mole can be inserted reversibly into the host structure at a high potential of 3.6 V vs. Li⁺/Li (against 3.4 V for α -V₂O₅ phase). It presents moreover a stable and reversible capacity of 140 mAh.g⁻¹ with a high capacity retention (about 95% of Q_{initial} at the 50th cycle) and a very high rate capability between C/10 and 5C.

It is furthermore possible to obtain in the extended 4 / 2.2 V potential range a lithium rich composition ζ -Li₂V₂O₅ with the insertion of two Li⁺/mole (280 mAh.g⁻¹) in the structure.

A structural analysis by XRD and Raman spectroscopy confirmed the presence of three successive phases in the system in the 4 / 2.2 V potential range and clearly defined the limits of the biphasic domains.

The structure of the Li-rich ζ -Li₂V₂O₅ phase was resolved par Rietveld refinement and this phase shows moreover a completely new Raman fingerprint.



*Discharge-charge curves of γ' -V₂O₅ and α -V₂O₅ in a LiClO₄/PC (1M) electrolyte at C/10.
In inset: Rate capability behavior at RT*

[1] J. M. Cocciantelli, P. Gravereau, J.P. Doumerc, M. Pouchard, P. Hagenmueller. *J. Solid State Chem.* **1991**, 93, 497.