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COBALT OXIDE NANOMATERIALS PREPARED BY CVD AS NEGATIVE ELECTRODES IN LITHIUM BATTERIES.

D. Barreca,^{1*} M. Cruz-Yusta,² A. Gasparotto,³ C. Maccato,³ J. Morales,²
A. Pozza,³ C. Sada,⁴ L. Sánchez,² E. Tondello³

¹ CNR-ISTM and INSTM - Department of Chemistry - Padova University, 35131 Padova, Italy;

² Dpto. de Química Inorgánica e Ingeniería Química - Universidad de Córdoba, 14071 Córdoba, Spain;

³ Department of Chemistry - Padova University and INSTM, 35131 Padova, Italy;

⁴ Department of Physics and CNISM - Padova University, 35131 Padova, Italy.

Among 3d transition metal oxide nanosystems, cobalt oxides (CoO and Co₃O₄) have received a considerable attention as anode materials for Li-ion batteries with attractive electrochemical performances. In spite of this widespread interest, a major drawback for their technological utilization is the modest capacity retention, which is still far from meeting the actual technological requests. On this basis, an open challenge is the development of alternative synthetic routes to cobalt oxide nanomaterials, enabling the simultaneous control of their phase composition and morphology and the exploitation of their applicative potential. This contribution presents an innovative procedure for the preparation of cobalt oxide nanoelectrodes supported on Ti substrates, whose key advantage is the absence of ancillary materials (e.g. binders, conductors) commonly used in electrode preparation. The target systems were grown by Chemical Vapor deposition (CVD) from a novel precursor, Co(hfa)₂.TMEDA (hfa = 1,1,1,5,5,5-hexafluoro-2,4-pentanedionate, TMEDA = N,N,N',N'-tetramethylethylenediamine), and characterized by Glancing Incidence X-ray Diffraction (GIXRD), Secondary Ion Mass Spectrometry (SIMS), Field Emission-Scanning Electron Microscopy (FE-SEM), and Atomic Force Microscopy (AFM). A suitable selection of the growth temperature and reaction atmosphere enabled to control both the phase composition (CoO vs. Co₃O₄) and the morphology of the resulting nanosystems, key issues to obtain improved functional performances as Li-cell anodes. The electrochemical reaction with Li⁺ ions was studied in the potential window 3.0-0.0 V, revealing a fast lithium storage process. High coulombic efficiencies and capacity retention upon cycling were observed for electrodes characterized by lower-sized particles and a higher surface roughness, enabling a shorter Li⁺ path length. Remarkably, the capacity recovery was the highest ever obtained up to date for nano-electrodes assembled without the use of ancillary materials. The present results candidate the proposed synthetic strategy as a valuable mean for the tailored synthesis of oxide nanoelectrodes endowed with improved functional performances.

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