

Published Article: [A multi-technique approach to understanding delithiation damage in LiCoO₂ thin films](#)

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IFIMAC researchers and members of the Department of Condensed Matter Physics and Instituto Universitario de Ciencia de Materiales Nicolás Cabrera, E. Salagre, S. Quílez, R. de Benito, M. Jaafar, H. P. van der Meulen, P. Segovia, E. G. Michel and C. Polop have developed a comprehensive study entitled “A multi-technique approach to understanding delithiation damage in LiCoO₂ thin films”, which has been recently published in the Scientific Reports Journal by Nature Research. The study, carried out in collaboration with researchers from the Consejo Superior de Investigaciones Científicas, the ESRF Synchrotron and Sandia National Laboratories, was conducted within the framework of the European M-era.Net 2018 StressLIC project (“Addressing the stress-related functional limitations of thin-film Li-ion components for energy-intensive applications”) under the coordination of UAM.

Using a multi-technique approach, which includes synchrotron radiation x-ray diffraction, scanning electron microscopy, micro-Raman spectroscopy, photoelectron spectroscopy and conductive atomic force microscopy, the authors have identified the different delithiation regimes of LiCoO₂ (LCO) thin film cathodes and have determined the balance between selective Li extraction and structural damage processes in each regime. This study presents important results applicable to processes of deep delithiation of lithium-ion batteries (LIBs) and the post-mortem recovery of Li.

LCO is the most common cathode material in the LIBs used in portable devices. The stored energy density of LIBs has increased slowly over the past decade, at a rate of approximately 10%/year. However, for LIBs to replace fossil fuels in the automotive industry a 500% gain is needed. Such a disruptive innovation is only feasible if we understand the degradation mechanisms of the battery performance on the nanoscale and take remedial action. With this goal in mind, the StressLIC consortium brings together researchers of the UAM with academic groups of the Montanuniversität Leoben (Austria), Consejo Superior de Investigaciones Científicas (Spain), Sandia National Laboratories (USA) and a larger industrial European partner, the company AVL List GmbH (Austria).