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In Situ EC-Raman Analysis of Ni-based Layered Double Hydroxide Phase Transition Under Alkaline OER

The quest for more efficient and sustainable catalysts for the oxygen evolution reaction in water electrolyzers has been focused, lately, on the use of layered double hydroxides (LDHs). These materials are appreciated for their reduced environmental impact, low cost and relatively high catalytic performance [1]. Studying their properties and efficiency, as well as their ease of scalability on large-scale stacks for hydrogen production, is the aim of the European project SEAL Hydrogen, which HORIBA integrated as one of the industrial partners. Our aim consisted in monitoring in real time the (electro)chemical changes occurring during the OER on several binary and ternary Ni-based LDHs [2] *via in situ* Raman spectroscopy. These analyses, supported also by *ex situ* Raman and glow-discharge optical emission spectroscopy (GD-OES) results, allowed determining the presence of structural and/or chemical changes and, overall, gaining a deeper understanding of the structure-activity relationships of the different catalysts, with the purpose of selecting the most promising candidates for the large-scale electrolyzers.

References

- [1] Song, F., Hu, X. Exfoliation of layered double hydroxides for enhanced oxygen evolution catalysis. *Nat Commun* 5, 4477 (2014).
- [2] Seijas-Da Silva A., Hartert A., Oestreicher V., Romero J., Jaramillo-Hernadéz C., Muris L. J. J., Thorez G., Vieira B. J. C., Ducourthial G., Fiocco A., Legendre S., Huck-Iriart C., Mizrahi M., López-Alcalá D., Freiberg A. T. S., Mayrhofer K. J. J., Waerenborgh J. C., Baldoví J. J., Cherevko S., Varela M., Thiele S., Lloret V. and Abellán G., *Nat Commun* 16, 6138 (2025)

Figures

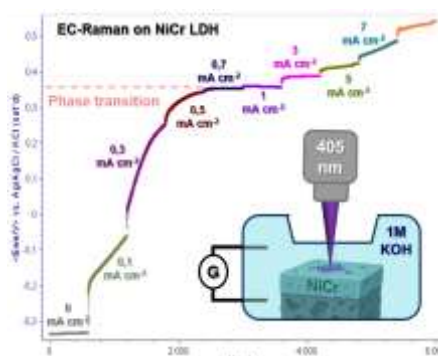


Figure: Example of an *in situ* electrochemical-Raman measurement on a NiCr LDH.