



Importance of systematic Raman spectroscopy studies of Layered Hydroxides

SEAL-HYDROGEN: From Lab Innovation to Industrial Scale -Up APRIL 28 & 29, Valencia – International Workshop

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Stable and efficient alkaline water electrolyzers with zero critical raw materials for pure hydrogen production

Industrial scale electrolyser

Next generation Zero Gap AWE Electrolyser

Scalable electrode production

Efficient and stable catalyst



Catalyst for Oxygen Evolution Reaction

High catalytic activity



Ni

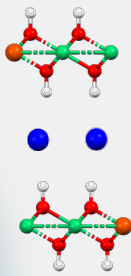


High active surface area

Layered structure



Layered hydroxide



Low crystallinity

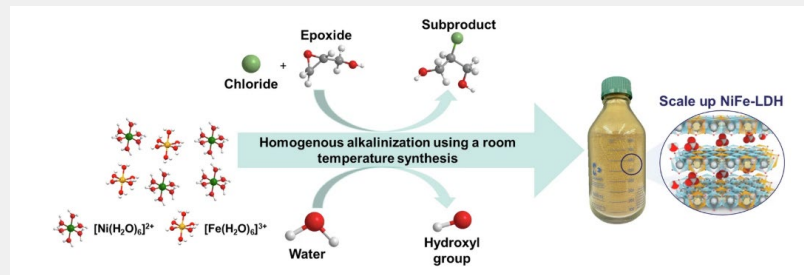


Epoxide route

Scalable synthesis



Epoxide route





Scalable synthesis of NiFe-layered double hydroxide for efficient anion exchange membrane electrolysis

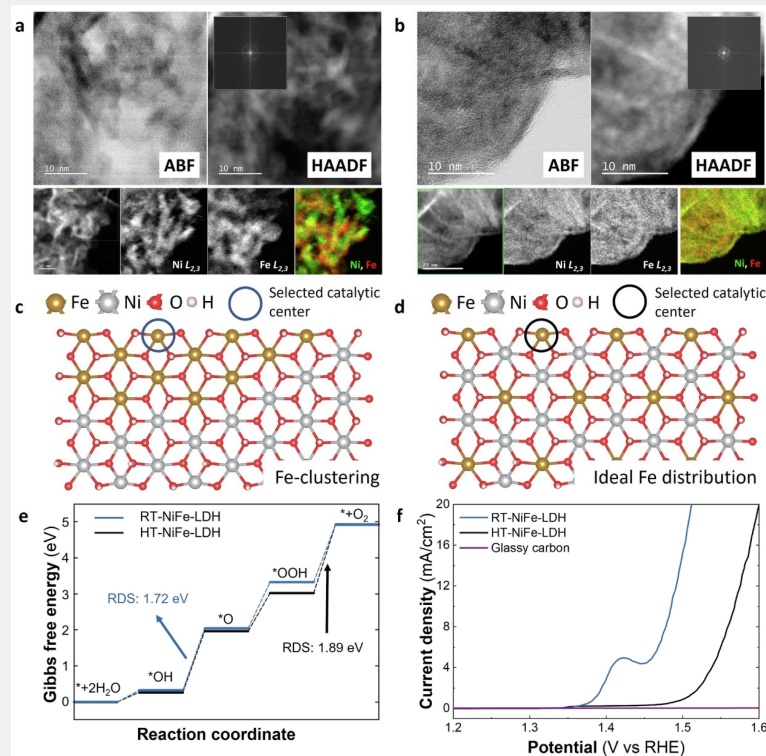
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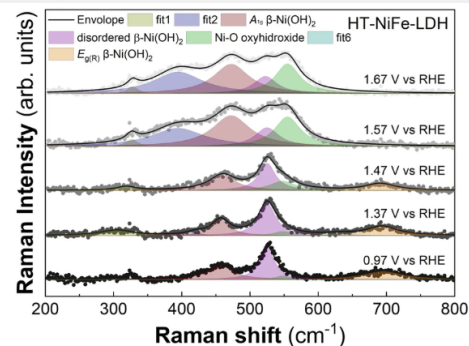
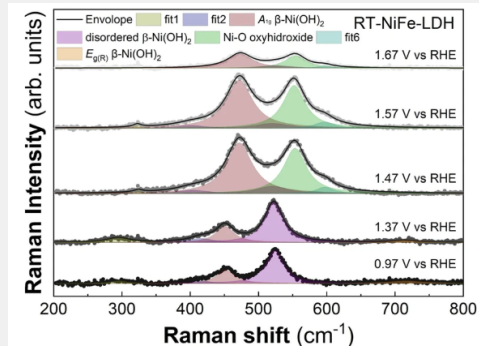
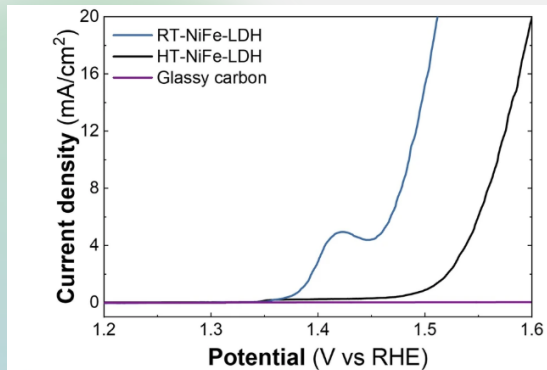
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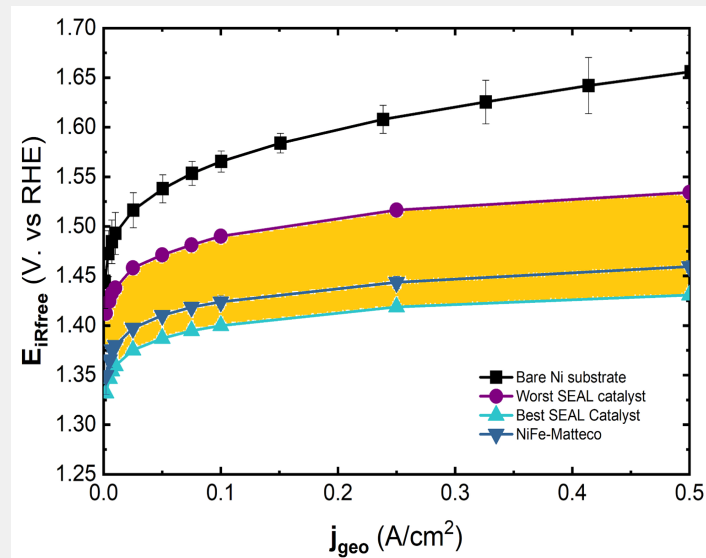
In-situ Raman spectroscopy



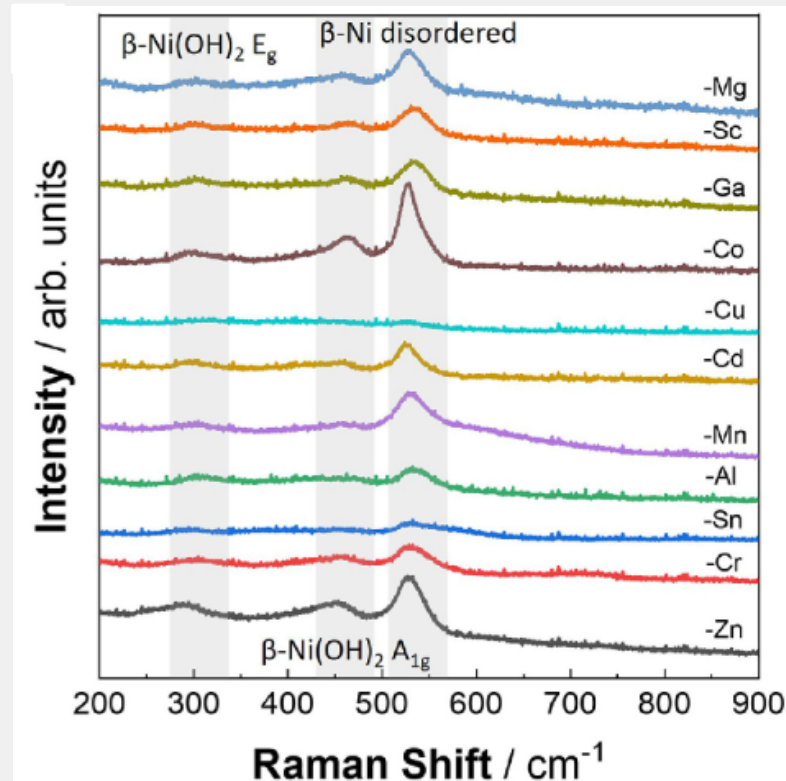
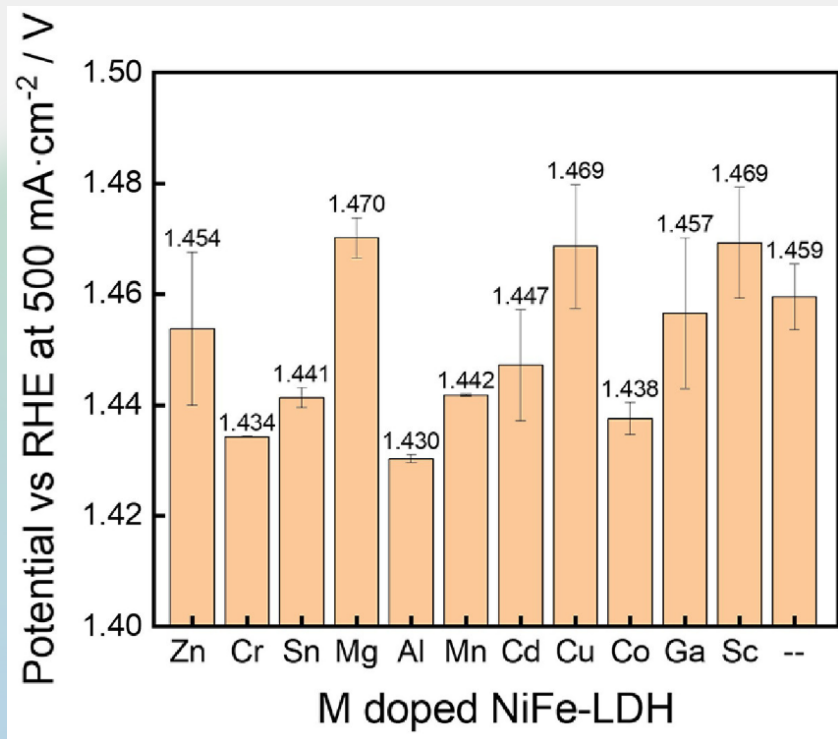
Next generation materials

Optimisation of the catalytic behaviour of LDHs

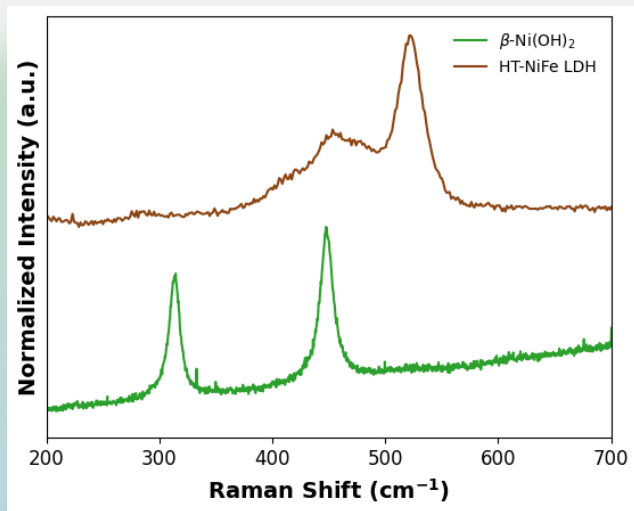
- Binary LDHs (NiX-LDH or mix hydroxide phase)
- Ternary LDHs with non-CRM elements (NiFeM-LDH)
- High-entropy LDHs materials (HE-LDH).
- Supported LDHs (S-LDH)
- Growth LDHs (GE-LDHs)
- Hybrid LDHs



Raman spectroscopy of Ternary LDH



Raman spectroscopy of Layered Hydroxides



Ni



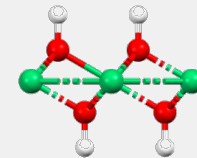
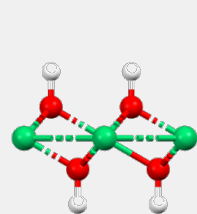
Fe



Cl⁻

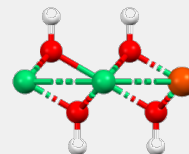
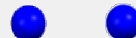
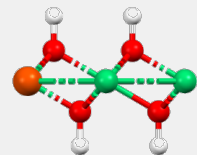
β -phase

Brucite-like

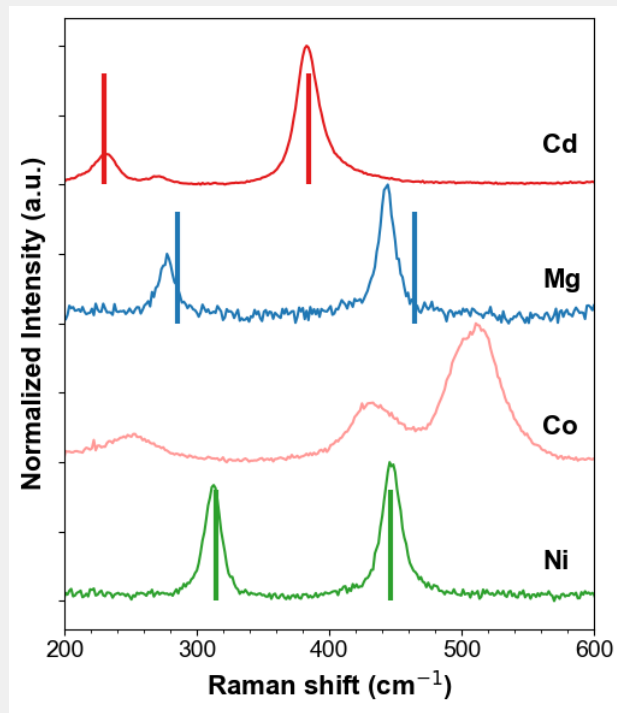
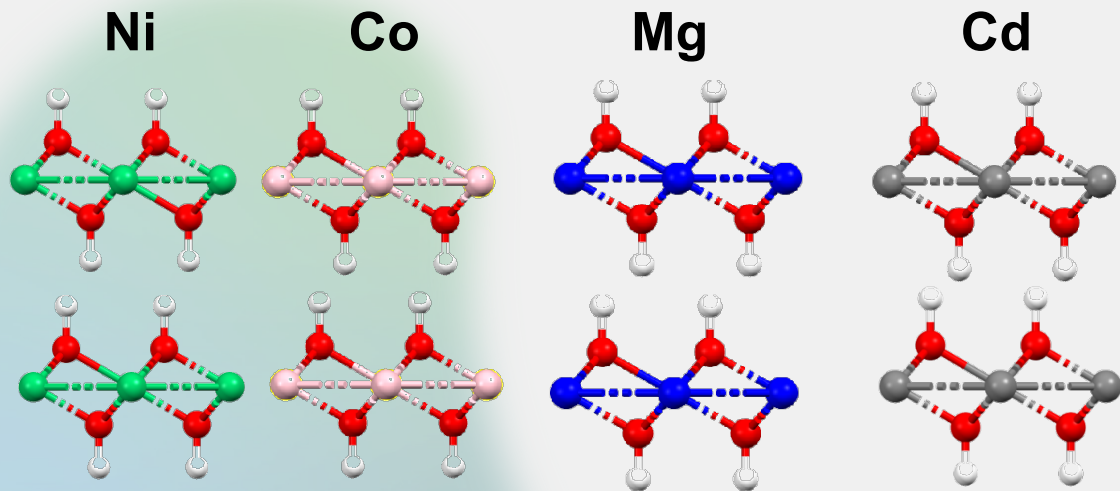


LDH-phase

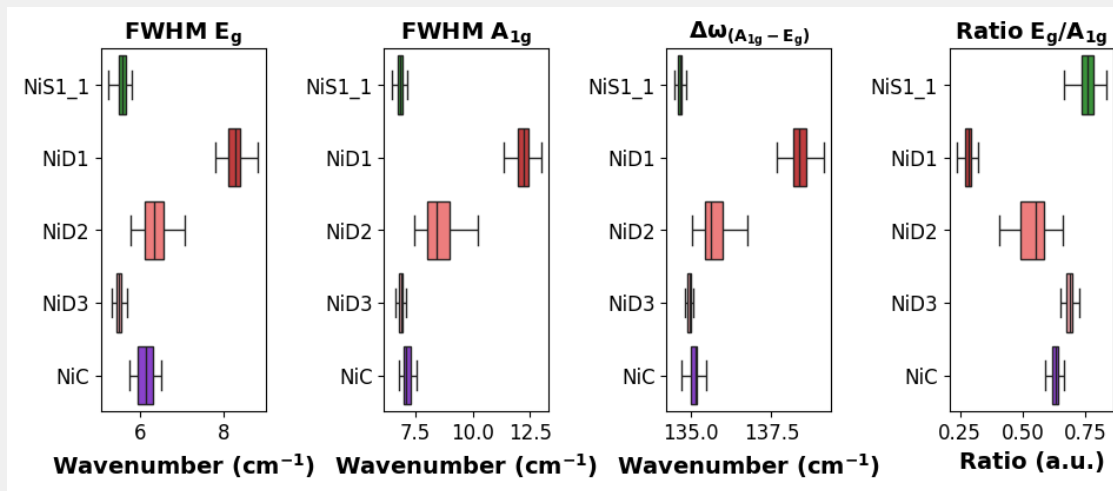
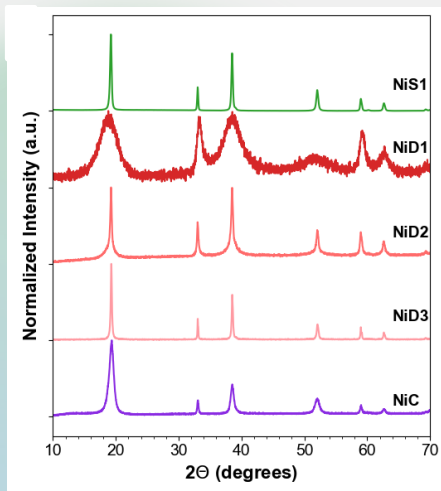
Hydrotalcite-like



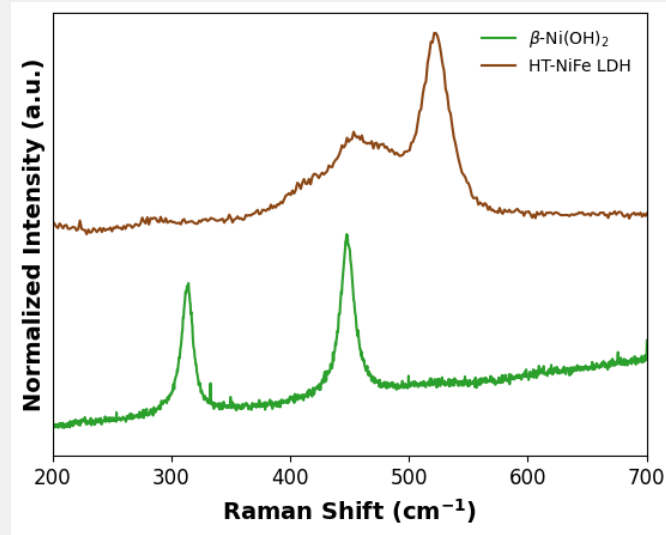
β -phase $M(\text{OH})_2$



Disorder in β -Ni(OH)₂



From β -LH to LDH



To ternary LDH to High Entropy LDH





NEXT GENERATION ALKALINE ELECTROLYSIS



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