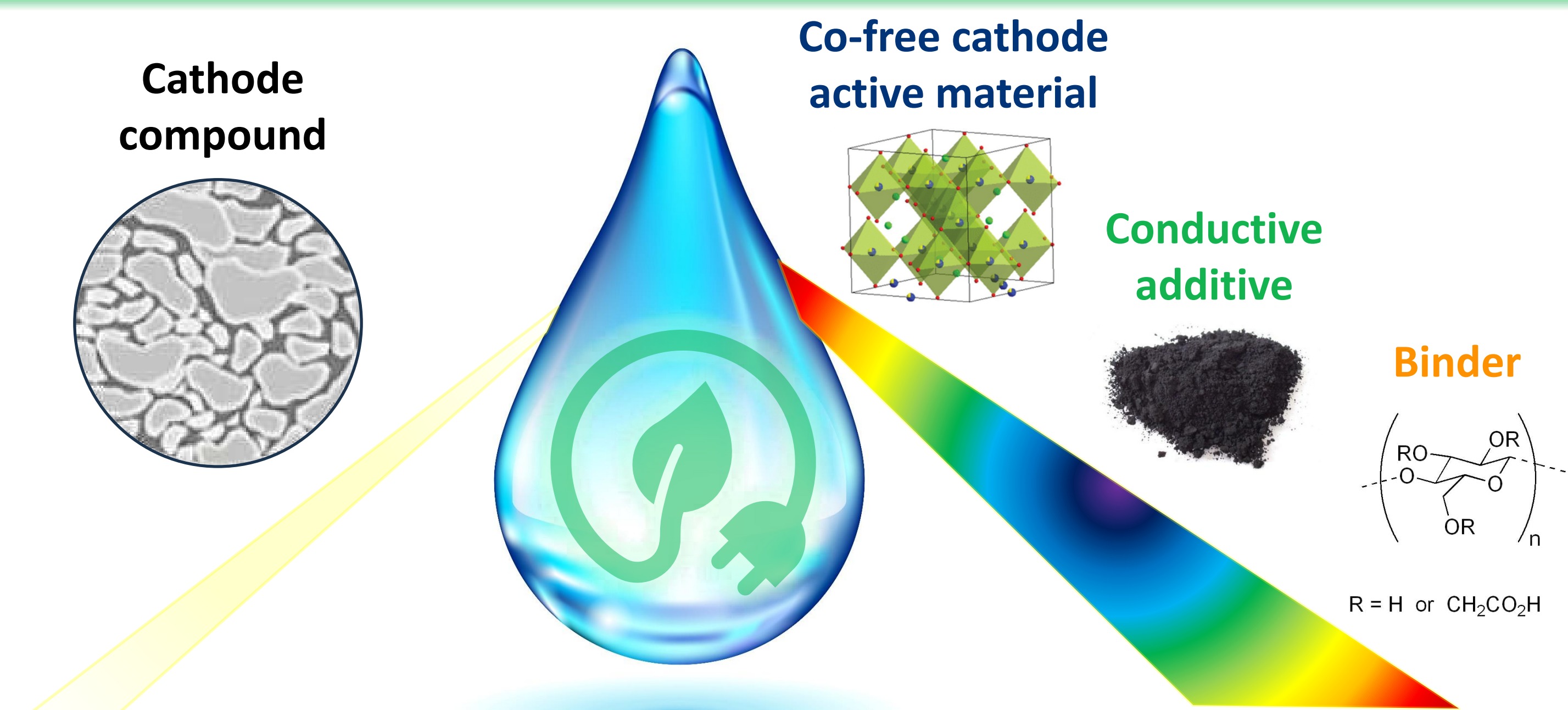
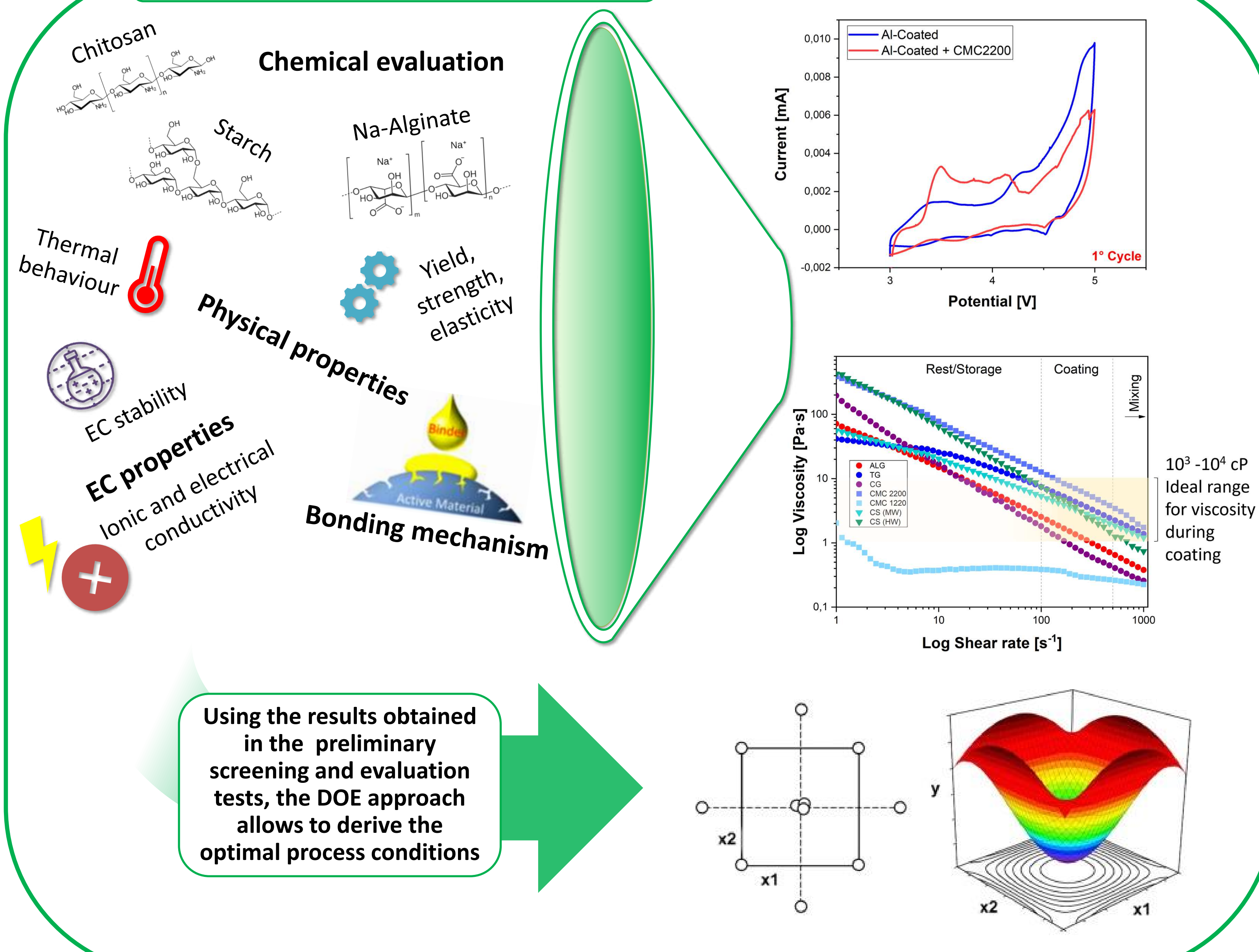
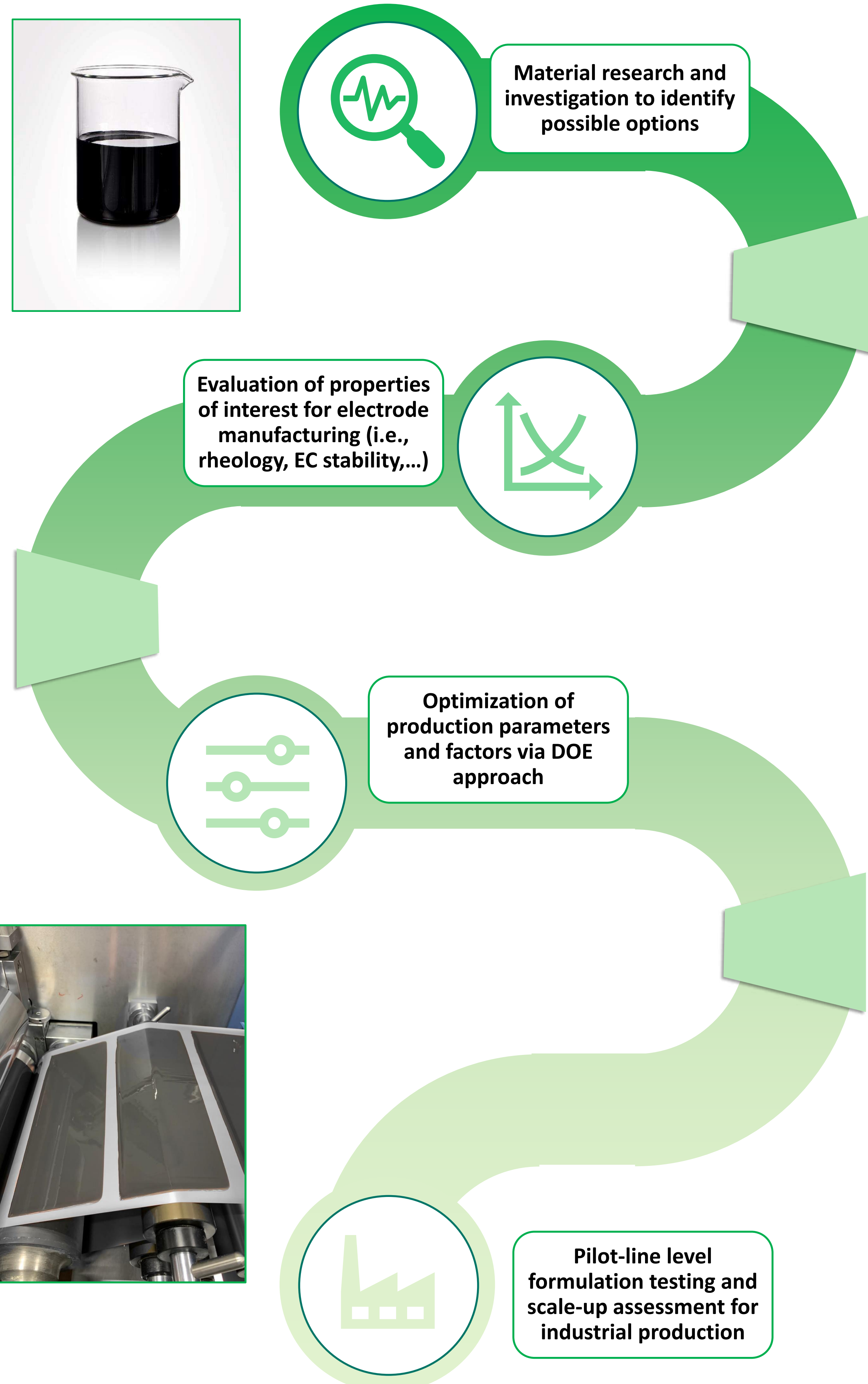


Introduction

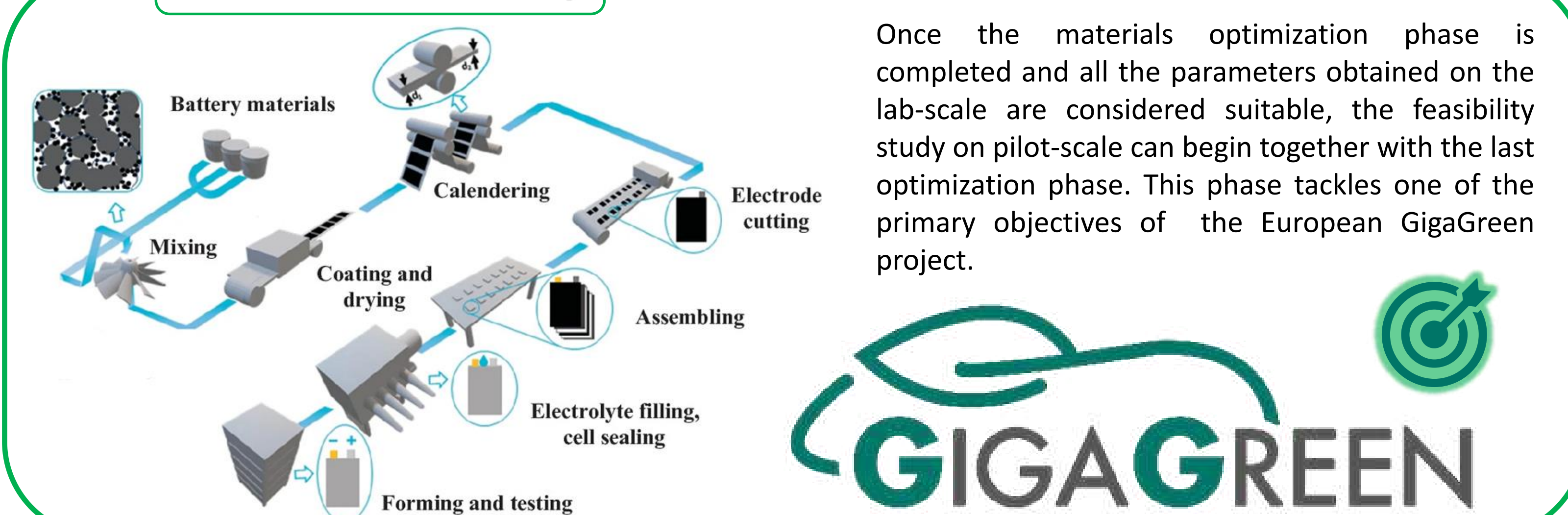
Electrochemical energy storage systems, notably lithium-ion batteries (LiBs), are pivotal in small electronics, stationary energy storage, and electric mobility. Addressing the growing market demands, as well as the reduction in content of CRM (Critical Raw Materials) in cathode compounds and the ban on fluorinated materials established by the EU community, necessitates substantial efforts to enhance both battery composition and performance, particularly in terms of power and energy densities. This improvement hinges on the utilization of innovative sustainable active materials and the efficient optimization of electrode and cell manufacturing processes. While active materials play a primary role in battery cell performance, non-active materials, constituting 60% of a LiB cell weight, significantly impact power and energy density, sustainability, costs, and overall lifespan. Thus, the choice and optimization of proper binders is imperative as they influence important properties (i.e., mechanical strength, flexibility, electrical, and ionic conductivities). Common binder choices include polyvinylidene fluoride (PVDF) and carboxymethyl cellulose (CMC) with styrene-butadiene rubber (SBR). Ongoing research aims at developing sustainable binders such as polysaccharides, starch derivatives, natural polymers, and gums. However, each binder choice has associated pros and cons, such as processing in water environments, impact on slurry properties, and cost considerations. This work focuses on optimizing a water-based electrode production process through a design of experiment (DOE) approach, concentrating on generation 3b cathodes.



Screening and optimization



Goals and scale-up



Conclusions

- Sustainability in the production of electrodes, and in particular of cathodes, passes through the elimination of high impact elements and the reduction of energy in every phase of the process.
- We presented a screening phase of various materials to be used as binders in aqueous solvents; the selection must go through the optimization of the pre-industrial production of the electrodes, which accounts for all the rheological properties even on a pre-industrial scale.
- The optimization process carried out before the scale-up phase allows for a considerable speeding up of times and a greater quality of the obtained products.

References & Disclaimers

- Cholewinski, A. *et al.* (2021) 'Polymer binders: Characterization and development toward aqueous electrode fabrication for Sustainability', *Polymers*, 13(4), p. 631. doi:10.3390/polym13040631.
- Chen, H. *et al.* (2018) 'Exploring Chemical, mechanical, and electrical functionalities of binders for advanced energy-storage devices', *Chemical Reviews*, 118(18), pp. 8936–8982. doi:10.1021/acs.chemrev.8b00241.

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