A charge ahead: Carrier pre-intercalation techniques boost alternative battery performance

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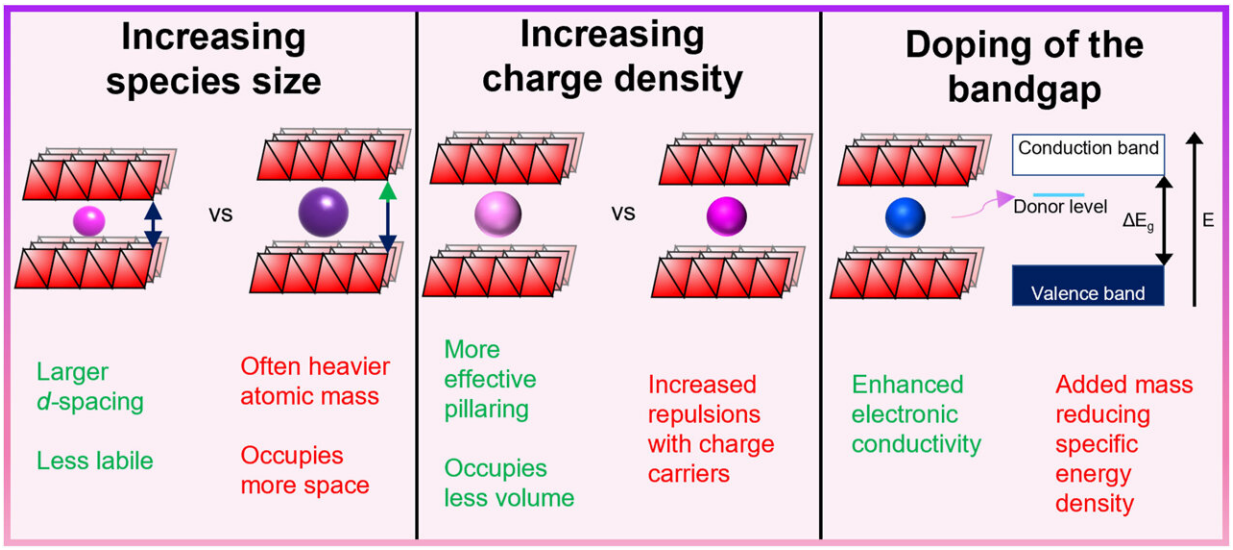

Schematic displaying the effects of altering a pre-intercalating species size and charge density, along with doping effects. Credit: *eScience* (2023). DOI: 10.1016/j.esci.2023.100183

As the demand for energy storage diversifies, the limitations of lithium supplies drive a shift toward alternative technologies. Sodium, potassium, magnesium, and zinc-ion batteries emerge as promising contenders, yet face challenges in capacity, charge-discharge rate, and stability. This backdrop underscores the need for innovative approaches

like carrier pre-intercalation to elevate the electrochemical performance of electrode materials.

Researchers from University College London's Department of Chemistry have made significant strides in battery technology with their study published in *eScience*, which delves into the carrier pre-intercalation process, providing a comprehensive review of how this method optimizes electrode materials for next-generation batteries.

The study comprehensively analyzes the effectiveness of carrier pre-intercalation in enhancing electrode materials for alternative battery technologies. Techniques such as chemical and electrochemical pre-intercalation are explored for their ability to insert beneficial ions into electrode structures, enlarge interlayer spacings and improve ion diffusion and electrical conductivity. These modifications significantly extend the stability and lifespan of sodium, potassium, magnesium, and zinc-ion batteries.

Dr. Yang Xu, co-author of the study, states, "This approach not only addresses the intrinsic shortcomings of non-lithium batteries but also aligns with global sustainability goals by reducing dependence on lithium, which is becoming increasingly scarce and expensive."

The implications of this research are profound and can promote the development of more sustainable energy storage systems. By enhancing the viability of sodium, potassium, magnesium, and zinc-ion batteries, carrier pre-intercalation could facilitate broader adoption in electric vehicles and grid storage, thereby influencing energy policies and market dynamics in the renewable energy sector.

More information: Charlie A.F. Nason et al, Pre-intercalation: A valuable approach for the improvement of post-lithium battery materials, *eScience* (2023). DOI: 10.1016/j.esci.2023.100183

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