DATE 12 June 2025

TIME 1115 - 1215 (AEST)

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Designer Electrolytes to Enable Advanced Batteries

Dr Mega Kar

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In recent years, Li-ion batteries have rapidly been adopted as the benchmark commercial energy storage technology for most applications despite having significant drawbacks: they pose serious safety risks due to their high reactivity, toxicity and flammability, and are subject to materials supply shortages due to the use of relatively scarce resources such as cobalt, lithium and graphite. It is widely viewed that new battery technologies will need to be developed as a sustainable and safe alternative to lithium-ion to fully transition to an emissions-free economy powered by renewable energy. The battery electrolyte is a key component that will unlock new battery chemistries and plays a core role in governing the safety characteristics of the battery. Therefore, there is a critical need to design inexpensive, non-flammable and stable materials for the next generation of rechargeable batteries.

This work reports the design of advanced electrolytes based on non-flammable and highly electrochemically stable borate ionic liquids as well as salts with weakly coordinating anions, that demonstrate the high electrochemical compatibility with Mg, Zn, Na and Li1-4. These anions play a key role in governing the overall nature of the solid-electrolyte interphase (SEI) in both Li and Na based devices, drastically improving battery performance and representing a breakthrough in the development of high-energy density batteries. Such highly promising findings open a valuable pathway to explore the family of borates based advanced electrolytes in detail for a wide range of emerging energy storage technologies.

References:

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[2]Roy, B.; Cherepanov, P.; Nguyen, C.; Forsyth, C.; Pal, U., Mendes, T.C.; Howlett, P.; Forsyth, M.; MacFarlane, D.R.; **Kar, M***., *Adv. Energ. Mater.*, **2021**, 11, 2101422.
[3]Duncan, D.; Roy, B.; Piper, S.; Nguyen C.; Howlett, P.; Forsyth, M.; MacFarlane, D.; Sun, J; **Kar, M***., *J. Phys. Chem. C*, **2022**, 126, 18918-18930.
[4]**Kar, M***, Anh Ha, T, Duncan D., Chen F., Cherepanov, C., Sun J., Pozo-Gonzalo, C., *Batt&Supercaps*, **2023**, 6, e20220041

Biography:

Dr. Mega Kar pursued her PhD at Monash University from 2012 to 2015. Following her doctoral studies, Dr. Kar served as an Alfred Deakin Research Fellow at Deakin University from 2021 to 2023, where she investigated novel, low-cost, and safe materials for energy storage devices. Recently, she received the Australian ARC DECRA Fellowship to explore new materials for advanced sodium technology. Her primary research interests include designing innovative ionic liquid and solid-state electrolytes for rechargeable lithium, sodium, magnesium, and zinc batteries.

For queries regarding the event contact
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