

# Ionic liquid-Based Electrolytes for next Generation Batteries

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For many reasons the development of cheap, safe and highly efficient batteries is today one of the major technical challenges. Li-ion batteries, although today well-established, have their limitations, especially in terms of safety, because of the use of liquid organic solvent-based electrolytes.

Ionic liquids are promising candidates for many types of post-lithium battery electrolytes, as they allow for increased safety due to their negligible vapor pressure, non-flammability and high thermal and electrochemical stability. Other benefits of ILs are their tunable properties, including dissolving power, polarity and surface tension. In our conference contribution we would like to give an overview, how this unique combination of properties can enhance the performance of selected types of batteries.

In the first example, we'd like to demonstrate for metal air-batteries, how ILs influence the solid electrolyte interface (SEI) as well as they have an effect on the overpotential at the electrodes, enabling the use of normal gas diffusion electrodes.<sup>[1]</sup>

Another field of actual research are Li-S batteries, where ILs are in the position to minimize the formation of soluble polysulfides and to reduce the formation of dendrites.<sup>[2]</sup> The latter feature can be also beneficial for sodium- or other types of metal-batteries.<sup>[3]</sup>

Nevertheless, ILs also provide benefits to Li-ion technologies: Together with our partners, we have recently made progress in the development of IL based electrolytes for self-healing Li-ion batteries. Therefore we investigated two approaches: In the first case classical ILs can be taken as ionogel-forming additives. In the second case ILs are polymerized in order to be used as conductive backbone. Both approaches are focusing on safety and as well on the performance of the battery.

In summary, in our contribution we will give some insight how we design ionic liquids for specific battery applications, where we have to meet often completely different properties in order to receive optimal results.

## REFERENCES

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 957225 (BAT4EVER)

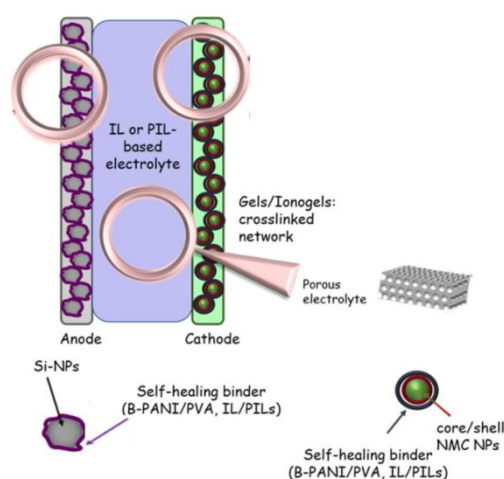


Fig 1. Self-healing battery concept developed in BAT4EVER