

Recent Advances on Magnesium Batteries Based on Ionic Liquids and δ -MgCl₂

Gioele Pagot^{1,2}, Federico Bertasi¹, Ketì Vezzù¹, Enrico Negro¹ and Vito Di Noto^{1,2}

¹Section of Chemistry for the Technologies, Department of Industrial Engineering, University of Padova, Via Marzolo 1, I-35131 Padova (PD), Italy, in the Department of Chemical Sciences

²Centro Studi di Economia e Tecnica dell'Energia Giorgio Levi Cases, Via Marzolo 9, 35131 Padova, Italy

E-mail: gioele.pagot@unipd.it

The main bottleneck towards the development of Magnesium secondary batteries is the lack of electrolytes that are safe, electrochemically stable, and compatible with the electrode materials. Recently published papers demonstrate that haloaluminate ionic liquids (ILs) can provide an appealing alternative to conventional ethereal electrolytes due to their low volatility, negligible flammability, and excellent electrochemical performance [1-4].

On these bases, an overview on recent advancements on electrolytes for secondary Magnesium batteries is presented, with particular reference to imidazolium and pyrrolidinium-based ionic liquids. Insights on the interplay between the structure and conductivity of BF₄⁻, Cl⁻/AlCl₃, Cl⁻/TiCl₄, and I⁻/AlI₃-based systems are given, thus providing an in-depth understanding of the relation between Mg-ion speciation, long-range charge transfer mechanism, and electrochemical performance of this very promising class of materials.

References

- [1] Bertasi, F.; Pagot, G.; Di Noto, V. et al. A Key Concept in Magnesium Secondary Battery Electrolytes. *ChemSusChem*. **2015**, 8, 3069-3076.
- [2] Bertasi, F.; Pagot, G.; Di Noto, V. et al. Toward a Magnesium-Iodine Battery. *Adv. Funct. Mater.* **2016**, 26, 4860-4865.
- [3] Bertasi, F.; Pagot, G.; Di Noto, V. et al. Interplay Between Structure and Conductivity in 1-Ethyl-3-methylimidazolium tetrafluoroborate/(δ -MgCl₂)_f Electrolytes for Magnesium Batteries. *Electrochim. Acta*. **2016**, 219, 152-162.
- [4] Pagot, G.; Bertasi, F.; Di Noto, V. et al. Three-dimensional Catenated 1-ethyl-3-methylimidazolium Halotitanate Ionic Liquid Electrolytes for Electrochemical Applications. *Electrochim. Acta*. **2017**, 246, 916-923.