イオン液体を用いたレアメタルフリー蓄電池の開発

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Development of rare-metal-free rechargeable batteries utilizing ionic liquids
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Demands for large-scale batteries are increasing across the world due to the spread of renewable energy resources. Current lithium-ion batteries are good candidates as they show high energy densities and long cycle life, making them suitable for not only portable devices but stationary use or electric vehicles. However, the utilization of non-ubiquitous resources such as lithium, cobalt, and nickel potentially pose risks of supply instability. Flammable organic-solvent-based electrolytes also induce serious safety concerns because large-scale batteries with low specific surface areas have difficulties of releasing generated heat. Thus, the author has focused on ionic liquids as promising electrolytes due to their electrochemical stability and safety. Toward applications as large-scale use, the author has developed several rare-metal-free rechargeable batteries utilizing ionic liquid electrolytes, including sodium and potassium secondary batteries.
Keywords : Rechargeable Battery; Ionic Liquid; Rare-Metal Free

再生可能エネルギーの利用拡大のためには、大型蓄電池を併設することが必要であり、現行のリチウムイオン電池は高エネルギー密度・長寿命などの観点から定置用や電気自動車用途として有望視されている。しかし、リチウム・コバルト・ニッケルなどの豊富ではない資源を大量消費することには、安定的な資源供給の面で潜在的リスクが存在する。また、可燃性の有機溶媒を電解液に使用する場合、大型蓄電池の安全性には一層の注意が必要である。筆者は大型蓄電池としての応用を目指し、電気化学的安定性と安全性の高いイオン液体を電解液に用い、ナトリウム二次電池やカリウム二次電池などのレアメタルフリー蓄電池の開発に取り組んできた[1,2]。

1) Amide-based ionic liquid electrolytes for alkali-metal-ion rechargeable batteries. T. Yamamoto, T. Nohira, *Chem. Rec.*, **2023**, *23*, e202300169.
2) Potassium-Based Dual-Carbon Battery with Pure Ionic Liquid Electrolyte. A. Yadav, H. Kobayashi, T. Nikaido, T. Yamamoto, T. Nohira, *J. Power Sources*, **2023**, *585*, 233628.