

# Modeling Zinc-Air Batteries with Ionic Liquids

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The large theoretical energy density of metal-air batteries has recently stimulated a lot of research on these high-potential batteries [1]. The extensive research revealed that enormous challenges lie ahead before the metal-air technology can outperform lithium ion batteries by a factor of two or three in terms of cost and energy density [2]. The key component is the electrolyte connecting the electrodes because it must be stable over a wide electrochemical window, allow reversible metal deposition, and be tolerant to air.

Ionic liquids are promising candidates for stable battery electrolytes [3]. Their advantages comprise a large electrochemical window (up to 6V), chemical and thermal stability, non-flammability (as safety asset) and low vapor pressure [4]. In particular, ionic liquids minimize dendrite growth during electrodeposition and have high ionic conductivity [4]. Zinc-air batteries with ionic liquids are potentially stable towards moisture as well as carbon dioxide and can support a reversible oxygen electrochemistry.

In this poster we present a thermodynamically consistent transport theory of zinc-air batteries based on room temperature ionic liquids. We focus on the systematic derivation of a set of fully coupled transport equations for the ions, charge and heat based on the development of modeling methodologies for lithium-ion batteries [5]. We use the framework of rational thermodynamics to study transport and reactions in zinc-air batteries with these electrolytes.

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