Modelling of Zinc-based Batteries

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The growing need for energy storage in stationary and mobile applications demands for electrochemical cells which are based both on available resources for reasonable costs and resources which allow for a reliable and environmentally friendly battery design [1,2]. Zinc-based batteries, such as NiZn or ZnAir, are promising candidates matching these requirements, but their cyclability and lifetime needs to improve.

Developing continuum scale models for Zn-based electrochemical cells will allow to simulate the physical and chemical phenomena taking place during charge/discharge cycles. By studying and evaluating the battery behaviour in simulations, a more profound understanding of the processes involved will be developed, leading to optimised battery designs. Such models have to include all relevant reactions taking place at the electrodes including oxygen and hydrogen formation as well as the transport processes in electrodes and electrolyte based on concentration, pressure and electric potential distribution [3]. By applying these models to micro-structure resolving simulations setups, the influence of electrode geometry and effects as Zn electrode shape change may be studied [4].

Thus, the focus of the research lies in the provision of models capable of describing the behaviour of Zn-based electrochemical cells, with the subsequent objective to enhance these battery types depending on low-cost, largely available and environmentally friendly materials.

References

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