张强[1], 沈馨[1]

[1]清华大学化学工程系

Abstract

Lithium (Li) metal is an ideal anode material to make high energy density batteries because of its ultrahigh specific theoretical capacity and the lowest reduction potential. Nevertheless, the growth of Li dendrites and uncontrollable side reaction trouble the practical use of Li anodes a lot. Solid electrolyte interface (SEI) which influence the transport of ions plays a critical role on these issues. Stable and uniform SEI can help to improve the performance of Li anodes. Therefore, it is important to explore the function mechanism of SEI upon plating and stripping.
Herein, a numerical model based on finite element method is constructed for tracking the stress evolution and rupture progress of SEI during electrodeposits (Figure 1). In this model, pristine nonuniform SEI gives rise to uneven Li deposition, further results stress concentration in SEI. Once crack or rupture emerges, the fluctuation of Li ion flow is aggravated. Two key values, uniformity and mechanical strength, are investigated. Also, different working conditions (large or small applied current) are discussed. In particular, the uniformity of SEI is the most important factor for prolonging the failure time of SEI. This model provides a more profound understanding of the influence of SEI on electrodeposits and a design guidance for constructing stable SEI.

Figures used in the abstract

Figure 1: Stress modeling of solid electrolyte interface.