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Numerical design of nano-porous carbon binder domain (CBD) phase in lithium-ion battery electrodes

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Lithium-ion battery performance can be significantly affected by porous electrode microstructures. The carbon binder domain (CBD) within an electrode structure is used to enhance mechanical stability and facilitate electronic conduction. The understanding of the CBD phase microstructure and how it affects the complex coupled transport processes is crucial. Inspired by the bimodal pore size distribution of electrode structures, a random field method is proposed to generate the multiple phase porous electrode structures in this work. Using this approach, the nano-porous CBD phase with tuneable pore size and transport properties can be generated. The effect of CBD phase distributions on the battery performance is evaluated. It is found that the increased nano-porosity from 0.3-0.6 can increase specific capacity of battery electrodes by 50 to 100%. For the first time, the nano-porous CBD phase and corresponding properties can be manipulated by algorithms - this gives new insights on the battery electrode design.

Participation

In-Person

References

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