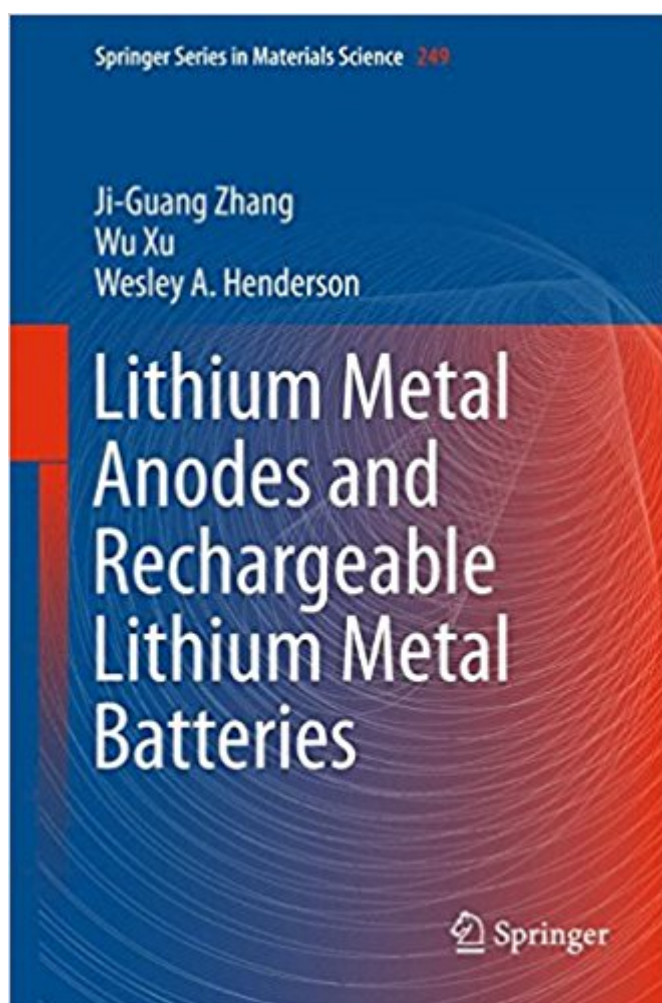




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Lithium Metal Anodes And Rechargeable Lithium Metal Batteries (Springer Series In Materials Science)



Synopsis

This book provides comprehensive coverage of Lithium (Li) metal anodes for rechargeable batteries. Li is an ideal anode material for rechargeable batteries due to its extremely high theoretical specific capacity (3860 mAh g⁻¹), low density (0.59 g cm⁻³), and the lowest negative electrochemical potential (-3.040 V vs. standard hydrogen electrodes). Unfortunately, uncontrollable dendritic Li growth and limited Coulombic efficiency during Li deposition/stripping inherent in these batteries have prevented their practical applications over the past 40 years. With the emergence of post Li-ion batteries, safe and efficient operation of Li metal anodes has become an enabling technology which may determine the fate of several promising candidates for the next generation energy storage systems, including rechargeable Li-air batteries, Li-S batteries, and Li metal batteries which utilize intercalation compounds as cathodes. In this work, various factors that affect the morphology and Coulombic efficiency of Li anodes are analyzed. The authors also present the technologies utilized to characterize the morphology of Li deposition and the results obtained by modeling of Li dendrite growth. Finally, recent developments, especially the new approaches that enable safe and efficient operation of Li metal anodes at high current densities are reviewed. The urgent need and perspectives in this field are also discussed. The fundamental understanding and approaches presented in this work will be critical for the application of Li metal anodes. The general principles and approaches can also be used in other metal electrodes and general electrochemical deposition of metal films.

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Summarizes the opportunities and main challenges in the application of Li metal anodes in electrochemical devices
Reveals the fundamental mechanism of metal dendrite growth during electrochemical processes
Reviews the main approaches and techniques used to investigate Li metal deposition processes and Li film morphologies
Suggests key areas for the further development of Li metal anodes
Highlights how the general principles and approaches developed for repeated deposition/stripping of smooth Li metal films can be used in other metal electrode and general electrochemical deposition of metal films

Dr. Ji-Guang (Jason) Zhang is a Laboratory Fellow of the Pacific Northwest National Laboratory. He is the group leader for PNNL's efforts in energy storage for transportation applications and has 25 years of experience in the development of energy storage devices, including Li-ion batteries, Li-air batteries, Li-metal batteries, Li-S batteries, and thin-film solid-state batteries. He was the co-recipient of two R&D 100 awards, holds 17 patents, and has published more than 200 papers in

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