# Article information:

Pressure-tailored lithium deposition and dissolution in lithium metal batteries | Nature Energy
<https://www.nature.com/articles/s41560-021-00917-3>

# Article summary:

1. Lithium metal is the ultimate anode material for high-energy rechargeable batteries, but its low Coulombic efficiency, short cycle life, and safety issues have prevented commercialization.

2. Pressure-tailored lithium deposition can improve cycling performance by minimizing dendrite growth and inactive lithium formation, and by precisely manipulating the morphology of lithium deposits.

3. Through a systematic study using cryogenic microscopy and molecular dynamics simulation, researchers achieved ultradense lithium deposition with an ideal columnar morphology and minimal surface area, improving Coulombic efficiency at fast charging conditions and opening up opportunities for high-energy rechargeable lithium metal batteries.

# Article rating:

Appears moderately imbalanced: The article provides some useful information, but is missing several important points or pieces of evidence that would be required to present the discussed topics in a balanced and reliable way. You are encouraged to seek a more balanced perspective on the presented issues by exploring the provided research topics and looking at different information sources.

# Article analysis:

The article discusses the challenges associated with using lithium metal as an anode material in rechargeable batteries and explores the potential of pressure-tailored lithium deposition and dissolution to overcome these challenges. The authors provide a detailed analysis of the effects of stack pressure on the physical morphology and chemical components of Li deposits, identifying two ways in which stack pressure regulates Li nucleation and growth: by tuning the favourable Li growth direction at the microscale and densifying Li deposits at the nanoscale.

The article provides a comprehensive overview of previous research on strategies to improve Li metal anode performance, including engineering electrolytes, utilizing 3D current collectors, creating artificial SEIs, and applying elevated temperature. However, it notes that these approaches alone cannot achieve the multidimensional requirements necessary for commercializing Li metal batteries.

The authors present their findings from a systematic study using cryo-FIB-SEM, cryo-TEM, titration gas chromatography (TGC), and molecular dynamics simulation to understand how stack pressure can be used to precisely manipulate Li deposition and dissolution towards high-performance rechargeable Li metal batteries. They achieved an ultradense Li deposition with an ideal columnar morphology and minimal surface area that was highly reversible on cycling with minimal inactive Li formation.

While the article provides a thorough analysis of the potential benefits of pressure-tailored lithium deposition and dissolution, it does not explore potential risks or limitations associated with this approach. Additionally, while it acknowledges previous research on strategies to improve Li metal anode performance, it does not provide a balanced discussion of alternative approaches or counterarguments.

Overall, while the article presents promising findings regarding pressure-tailored lithium deposition and dissolution as a solution to challenges associated with using lithium metal as an anode material in rechargeable batteries, readers should be aware of potential biases or limitations in its reporting.

# Topics for further research:

* Risks and limitations of pressure-tailored lithium deposition and dissolution in rechargeable batteries
* Alternative approaches to improving Li metal anode performance in batteries
* Challenges associated with using lithium metal as an anode material in batteries
* Electrolyte engineering for high-performance rechargeable batteries
* 3D current collectors for improving battery performance
* Artificial SEIs for enhancing battery stability and performance

# Report location:

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