# Article information:

Lithium superionic conductors with corner-sharing frameworks | Nature Materials
<https://www.nature.com/articles/s41563-022-01222-4>

# Article summary:

1. All-solid-state batteries are becoming more popular as they replace the flammable organic liquid electrolyte in conventional batteries with an inorganic solid electrolyte, which allows for high-energy electrodes and increased safety.

2. The development of solid electrolytes with high ionic conductivity and electrochemical stability is crucial for the realization of all-solid-state batteries.

3. Researchers have identified a corner-sharing framework as a common structural feature among many oxide superionic conductors, which can be used as a descriptor to discover potential lithium superionic conductors through computational screening. Ten newly discovered oxide conductors were experimentally validated, including LiGa(SeO3)2, which showed very high bulk ionic conductivity.

# Article rating:

May be slightly imbalanced: The article presents the information in a generally reliable way, but there are minor points of consideration that could be explored further or claims that are not fully backed by appropriate evidence. Some perspectives may also be omitted, and you are encouraged to use the research topics section to explore the topic further.

# Article analysis:

The article titled "Lithium superionic conductors with corner-sharing frameworks" published in Nature Materials discusses the development of solid-state batteries using inorganic solid electrolytes (SEs) instead of flammable organic liquid electrolytes. The article highlights the importance of SEs with high ionic conductivity and electrochemical stability for the realization of all-solid-state batteries. The authors identify a corner-sharing (CS) framework as a structural feature common to many oxide superionic conductors, which can be used as a descriptor in high-throughput computational screening to discover potential lithium superionic conductors.

The article provides a detailed explanation of the screening process and identifies ten new oxide structural frameworks that are predicted to exhibit superionic conductivity. The concept is experimentally validated in LiGa(SeO3)2, a new oxide conductor that shows a very high bulk ionic conductivity of 0.11 mS cm−1. The authors argue that the CS framework provides access to a highly distorted lithium environment and allows for percolating pathways through which lithium can move with low energy barriers, explaining the origin of fast lithium diffusion in multiple known and predicted oxide superionic conductors.

Overall, the article presents an interesting approach to discovering potential lithium superionic conductors using computational screening based on structural features. However, there are some potential biases and limitations to consider. Firstly, the article focuses solely on oxide SEs and does not discuss other types of SEs such as sulfide-based SEs or polymer-based SEs. This may limit the scope of potential candidates for all-solid-state batteries.

Secondly, while the CS framework is identified as a critical structural feature appearing in many existing and potential ionic conductors, it is unclear whether this is the only important feature or whether other factors such as chemical composition or crystal structure also play significant roles in determining ionic conductivity. Additionally, it is unclear how generalizable this approach is beyond the specific set of compounds screened in this study.

Thirdly, while LiGa(SeO3)2 is experimentally validated as a new oxide conductor with high bulk ionic conductivity, there is no discussion of its electrochemical stability or safety concerns associated with its use in all-solid-state batteries. It would be important to investigate these aspects before considering its practical application.

Finally, while the article presents an interesting approach to discovering potential lithium superionic conductors using computational screening based on structural features, it does not explore counterarguments or alternative approaches that may also be effective in identifying new SEs for all-solid-state batteries.

In conclusion, while the article presents an innovative approach to discovering potential lithium superionic conductors using computational screening based on structural features, there are some limitations and biases to consider. Further research is needed to investigate other factors that may influence ionic conductivity and electrochemical stability and to explore alternative approaches for identifying new SEs for all-solid-state batteries.

# Topics for further research:

* Alternative types of solid electrolytes for all-solid-state batteries
* Factors influencing ionic conductivity in solid electrolytes
* Electrochemical stability of oxide superionic conductors
* Safety concerns associated with using new solid electrolytes in batteries
* Limitations of computational screening for discovering new solid electrolytes
* Advances in all-solid-state battery technology beyond solid electrolytes

# Report location:

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