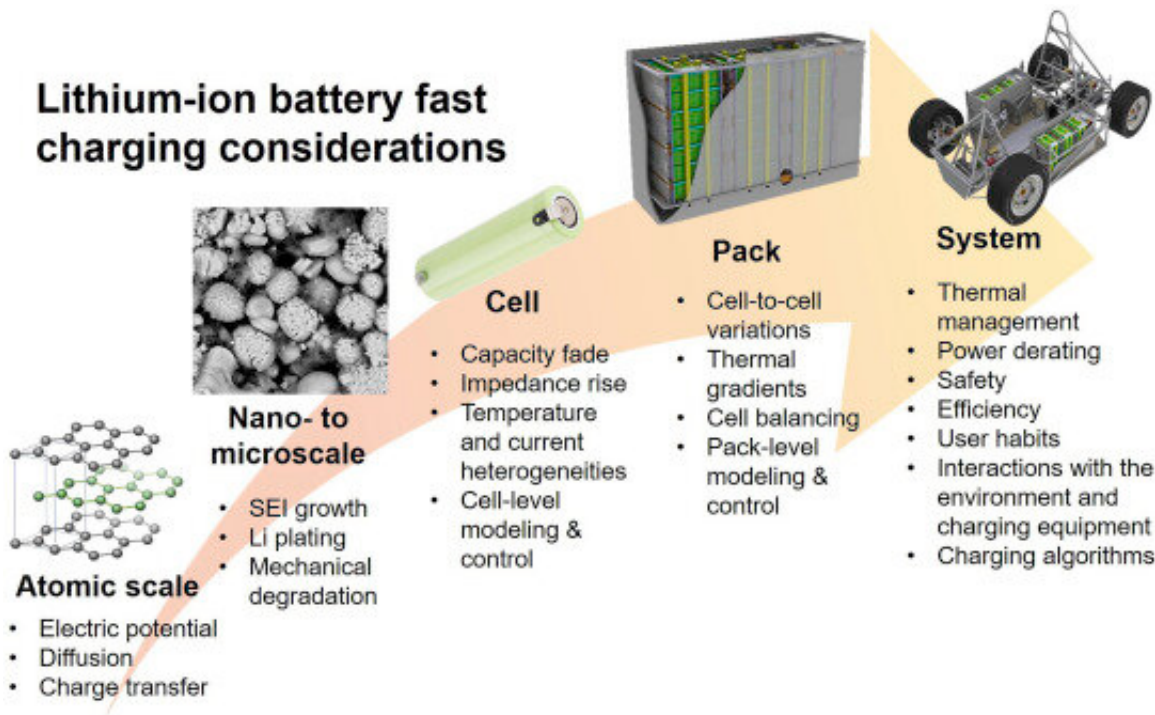


Lithium-ion battery fast charging: A review

July 7 2022



Key factors affecting Li-ion battery fast charging at different length scales.
Credit: *eTransportation* (2019). DOI: 10.1016/j.etrans.2019.100011

Lithium-ion batteries currently power most portable electronic devices, electric vehicles and energy grid storage facilities. Researchers worldwide are working to improve the performance of these batteries.

An article in the open access journal *eTransportation* reviews current research into the [physical phenomena](#) that limit battery charging speeds, the degradation mechanisms that commonly result from charging at high

currents, and the approaches proposed to address these issues.

The survey was performed by Anna Tomaszewska and colleagues at Imperial College, London, U.K., together with co-authors at several institutions in China and the U.S.

Two of the main issues hindering the wider adoption of [electric vehicles](#) are consumer concerns about range limitations and the length of time required to recharge batteries.

The high currents needed to accelerate the charging process are known to reduce energy efficiency and promote faster deterioration in battery capacity and [power output](#). The authors critically assess a variety of approaches to address these problems, giving particular attention to the challenges posed by charging at low temperatures. They identify key gaps in knowledge and make recommendations for the direction of future research.

Key requirements include the need to develop reliable methods to detect degradation as the batteries are used, and methods to control the temperature of batteries, to avoid overheating while charging, but to preheat them in cold weather.

Other transformative innovations may come from different and more robust electrode materials. Also, methods used to control the charging current into the batteries are at present rather limited. These could become more sophisticated and effective through the use of modeling to inform the development of improved control methods, the authors say.

Electrification of vehicles and many other power-hungry applications is one of the most promising avenues to combat [climate change](#) but much further research and [technological advancement](#) will be needed to exploit its full potential.

More information: Anna Tomaszewska et al, Lithium-ion battery fast charging: A review, *eTransportation* (2019). [DOI: 10.1016/j.etrans.2019.100011](https://doi.org/10.1016/j.etrans.2019.100011)

Provided by Springer

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