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Hard and soft X-ray absorption spectroscopy as powerful tools to deepen the understanding of the charge storage mechanisms in lithium-ion battery materials

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Lithium-ion batteries are the state-of-the-art electrochemical energy storage technology and applied in wide range of devices, including inter alia portable electronic devices, power tools, (hybrid) electric vehicles, and stationary storage installations [1–3]. However, this tremendous success also calls for further improvement concerning their energy and power density, sustainability, and cost efficiency. While large improvements have been and will be realized by advanced battery, cell, and electrode designs, the development of new active material candidates is at the forefront of scientific activities. This frequently involves also new charge storage mechanisms that have been unexplored so far, e.g., combined alloying and conversion reactions as well as novel insertion-type processes.
Herein, the important role of hard and soft X-ray absorption spectroscopy will be highlighted to develop an in-depth understanding of these new reaction mechanisms, including the impact of the elemental composition of such materials for the processes occurring in the bulk of these new materials and at the interface with the electrolyte.

References

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