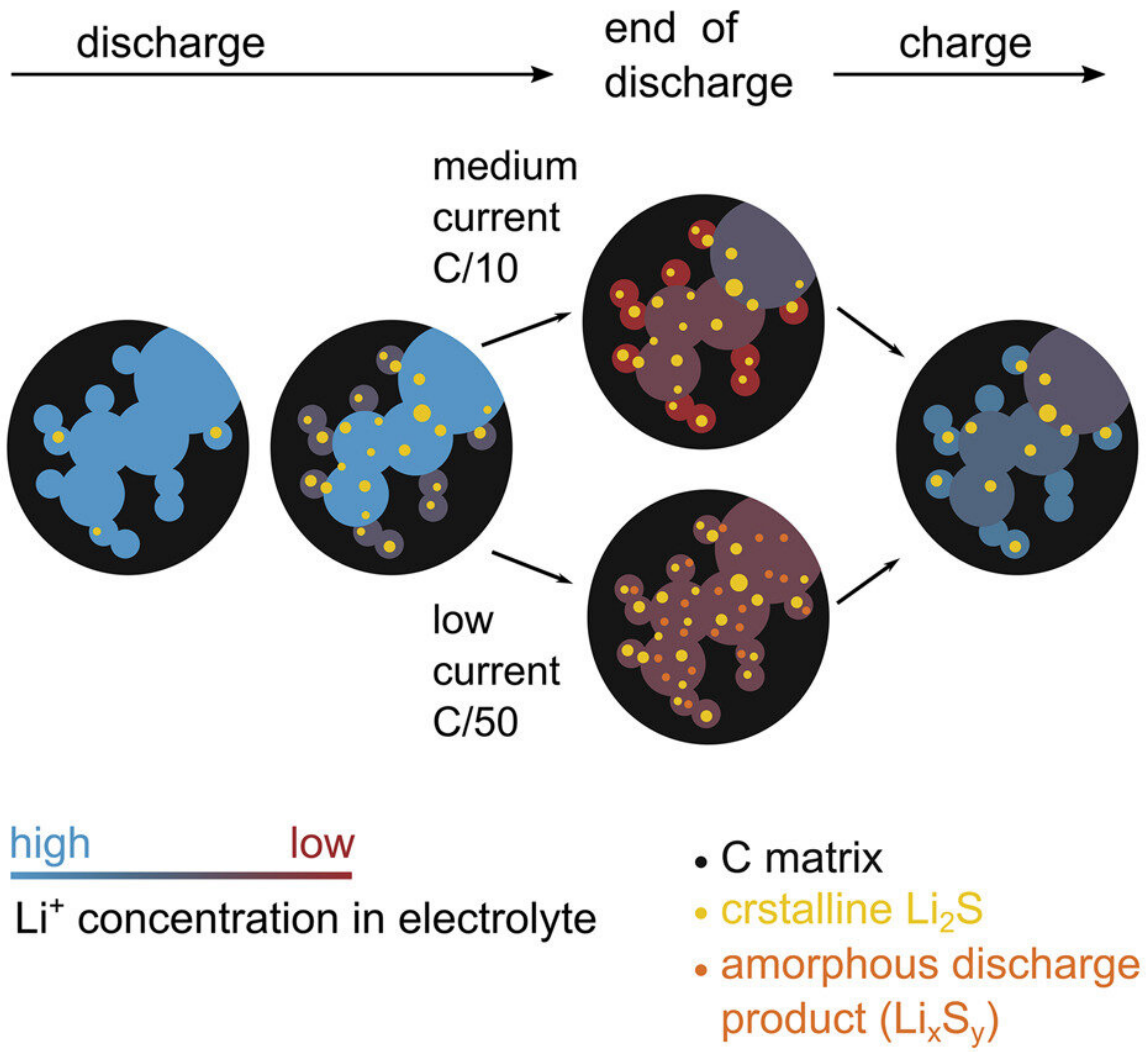
Eliminating the bottlenecks in performance of lithium-sulfur batteries

March 24 2022



Graphical abstract. Credit: *Chem* (2022). DOI: 10.1016/j.chempr.2022.03.001

Energy storage in lithium-sulfur batteries is potentially higher than in lithium-ion batteries but they are hampered by a short life. Researchers from Uppsala University in Sweden have now identified the main bottlenecks in performance.

Lithium-sulfur batteries are high on the wish-list for future batteries as they are made from cheaper and more environmentally friendly materials than lithium-ion batteries. They also have higher energy storage capacity and work well at much lower temperatures. However, they suffer from short lifetimes and energy loss. An article just published in the journal *Chem* by a research group from Uppsala University has now identified the processes that are limiting the performance of the sulfur electrodes that in turn reduces the current that can be delivered. Various different materials are formed during the discharge/charge cycles and these cause various problems. Often a localized shortage of lithium causes a bottleneck.

"Learning about problems allows us to develop new strategies and materials to improve battery performance. Identifying the real bottlenecks is needed to take the next steps. This is big research challenge in a system as complex as lithium-sulfur," says Daniel Brandell, Professor of Materials Chemistry at Uppsala University who works at the Ångström Advanced Battery Centre.

The study combined various radiation scattering techniques: X-ray analyses were made in Uppsala, Sweden and neutron results came from a large research facility, the Institut Laue Langevin, in Grenoble, France.

"The study demonstrates the importance of using these infrastructures to

tackle problems in materials science," says Professor Adrian Rennie. "These instruments are expensive but are necessary to understand such complex systems as these batteries. Many different reactions happen at the same time and materials are formed and can disappear quickly during operation."

The study was carried-out as part of a co-operation with Scania CV AB.

"Electric power is needed for the heavy truck business and not just personal vehicles. They must keep up with developments of a range of different batteries that may soon become highly relevant," says Daniel Brandell.

More information: Adrian R. Rennie, Correlations between Precipitation Reactions and Electrochemical Performance of Lithium Sulfur Batteries Studied by Operando Scattering Techniques, *Chem* (2022). DOI: 10.1016/j.chempr.2022.03.001. www.cell.com/chem/fulltext/S2451-9294(22)00128-0

Provided by Uppsala University