RECHARGEABLE BATTERIES

Making lithium–sulfur batteries less stressful

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Rechargeable lithium–sulfur batteries have the potential to replace lithium-ion batteries because of their higher specific energy. However, their performance drops after multiple charging cycles as the absorption and release of lithium ions is accompanied by large volume changes in the sulfur cathode, which stresses the surrounding material and causes permanent damage that lowers the capacitance. Currently, this is mitigated by limiting the ion loading or having thinner electrodes, but this restricts overall performance. Mahdokht Shaibani, Mainak Majumder and colleagues have now designed expansion-tolerant sulfur cathodes that can reduce stresses when charged and can sustain loadings of up to 15 mg cm^{-2} .

The researchers — who are based at institutions in Australia, Belgium and Germany — investigated different slurries of sodium carboxymethylcellulose binder,

which binds the active material and the conductive filler in the electrode. Unlike conventional binder that forms a dense network, the optimized slurry produces binders that ‘bridge’ neighbouring particles. Though the change in binder composition, compared to previous electrodes, is minimal, the new architecture is more mechanically stable as there is space for the electrode to expand in, and improves ion diffusion as less active surface area is covered. Lithium–sulfur batteries with the optimized binder demonstrated areal capacities of 19 mA h cm^{-2} and coulombic efficiency over 98%, which remain stable after 200 charging cycles.

Matthew Parker

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