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How the interaction between styrene-butadiene-rubber (SBR) binder and a secondary fluid affects the rheology, microstructure and adhesive properties of capillary-suspension-type graphite slurries used for Li-ion battery anodes

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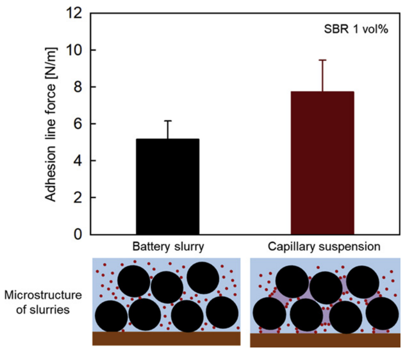
GRAPHICAL ABSTRACT

Here, we investigate how SBR particles, frequently used as a binder in graphite slurries, affect the structure and flow of the wet paste as well as the adhesion of the dry anode layer. We revealed that the SBR particles are located at the interface of both liquid phases, and the amount of added SBR and the energy input for dispersing the secondary fluid offer extra degrees of freedom for adjusting the flow properties and microstructure according to processing and product demands. Most importantly, at a given SBR content, the adhesion strength of the capillary-suspension-type graphite slurries to the current collector is substantially higher than for the anode layers made from conventional suspensions.



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ABSTRACT

The distinct structure and flow properties of capillary suspensions, i.e., ternary solid/fluid/fluid systems including two immiscible fluids, make these kinds of slurries promising candidates for the fabrication of Li-ion battery electrodes. Recently, aqueous graphite slurries have been introduced that have beneficial coating properties and yield high-capacity cells with a superior electrochemical performance. Here, we investigate how SBR particles, frequently used as a binder in graphite slurries, affect the structure and flow of the wet paste as well as the adhesion of the dry anode layer. Combining rheological, interfacial and structural investigations revealed that the SBR particles are located at the interface of both liquid phases, and the amount of added SBR and the energy input for dispersing the secondary fluid offer extra degrees of freedom for adjusting the flow properties and microstructure according to processing and product demands. Most importantly, at a given SBR content, the adhesion strength of the capillary-suspension-type graphite slurries to the current collector is substantially higher than for the anode layers made from conventional suspensions. This novel approach promises battery electrodes with extended durability at a low binder content and improved electrical conductivity.

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