Correlating mechanofusion process parameters to CB deagglomeration behaviour through C65-coated NMC622 electronic conductivity

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ABSTRACT

Factors involved in each process step affect final conductivity of electrodes1. No relationship interlinking these factors has been established yet. This project aims at aiding ongoing efforts of transition to dry processing of cathodes by:
• Investigating CB deagglomeration behaviour through mechanofusion of NMC622 and C65
• Studying influence of mechanofusion parameters on CB deagglomeration
• Evaluating the percolation threshold of coated particles

MOTIVATION

WHY SOLVENT FREE PROCESSING?
• Shorten process time and increase cost-effectiveness by eliminating drying step

CONCLUSIONS

The higher the proportion of carbon black used in the formulations, the more it dominates bulk pathways and contact points. Slower deagglomeration to mixing time increases as CB loading is increased. The higher the proportion of carbon black used in the formulations, the more it dominates bulk resistivity. For low carbon loadings:
• Low speeds desired for high mixing times
  • Greater retention of long CB chains and less spherization of CB coated NMC622 (Fig. c)
• Medium speeds desired for short mixing times
  • Optimal deagglomeration of CB to achieve low resistivity

For high carbon loadings: lower speeds favoured (Fig. g, h)
• Lower degree of deagglomeration of interconnected CB chains which form the bulk of the electronic conductive pathways

RESULTS

PROCESS PARAMETERS

Greater mixing times lead to increased resistivity.
• Spherization of carbon-coated NMC622 particles (Fig. d & e) results in coating with less large aggregates → less contact surface area with other NMC622 and C65 particles
• Breakdown of “long-range” C65 aggregates which form electronic pathways (Fig. f & g)
• Sensitivity of change in resistivity to mixing time increases as CB loading is increased

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LOADING

Vol. Resistivity (Ω.cm)

Percolation threshold = 0.5 – 1 wt% CB

Concentration after which sharp decrease in resistivity is observed.

Percolation threshold = 0.5 – 1 wt% CB

Vol. Resistivity (Ω.cm)

CB DEAGGLOMERATION

• CB agglomerates → CB aggregates → CB coated onto active material particles

CB deagglomeration

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REFERENCES


NEXTRONDE

MECHANOFUSION FOR NEXT-GENERATION LITHIUM-ION BATTERY CATHODE MANUFACTURING

CONTACT

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