Influence of Processing Parameters on the Properties of Graphite Anodes for Lithium Ion Batteries

Marcus Müller*, Dorit Nötzel, Christian Brösicke, Fatih A. Çetinel, Werner Bauer, Regina Knitter

Institute for Applied Materials IAM-WPT, Karlsruhe Institute of Technology

Replacement of Li metal anodes by selected carbon and graphite materials marked the commercial breakthrough for lithium ion battery technology in the field of consumer electronics (1990). However, to utilize LIB for electromotive and stationary applications further improvements are mandatory.

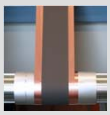
The correlation between microstructural parameters and electrochemical properties of graphite already has been intensively investigated. Motivation for our work is to understand in more detail the influence of electrode processing parameters on the cell performance.

Processing

Slurry

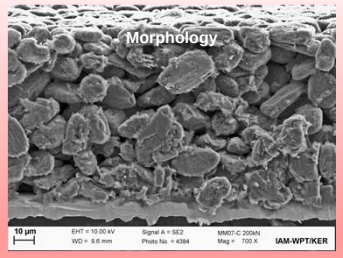
Graphite
Carbon black
CMC
SBR
Water

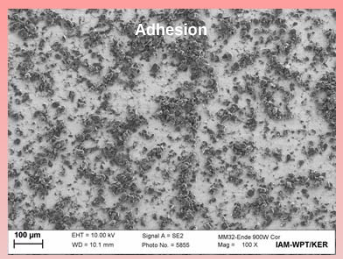
Coating

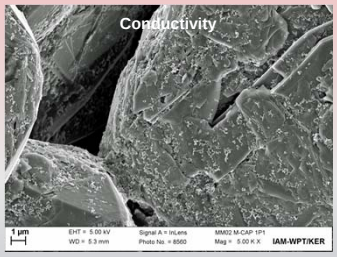


Calendaring

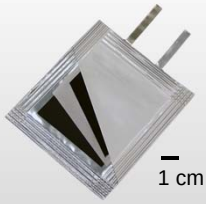
Electrode

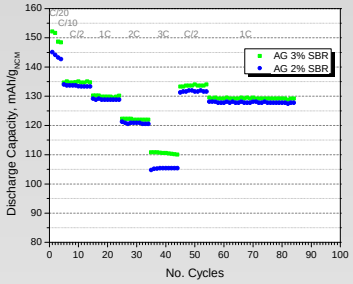


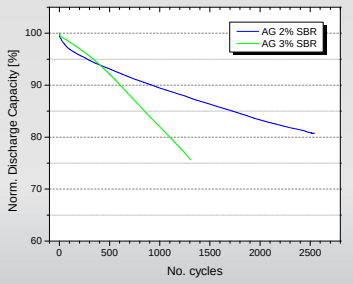




Electrochemical Properties







Carbon
- Degree of crystallinity.
- Particle size, morphology.
- Surface area (BET), surface chemistry.
- Particle coatings

Slurry
- Active material (carbon)
- Inactive materials (binder, conductive aid, thickener, wetting aid, dispersant).
- Mixing process – deagglomeration.
- Rheology.

Coating
- Foil pretreatment – wetting behavior.
- Thickness homogeneity.
- In-line drying – vacuum drying.

Calendaring
- Intensity: force, gap, temperature.
- Distortion, bending.

Electrode morphology
- Density – porosity, pore size.
- Areal mass loading.
- Homogeneity (binder distribution)
- Roughness.

Adhesion strength
- Particle – particle.
- Particle – current collector (copper foil).

Electronic conductivity

Capacity (reversible)

Capacity losses (irreversible)

Rate Capability

Degradation / Ageing

Reproducibility / Scattering (*robustness*)

Acknowledgement

Supply of binders by *JSR Micro* and graphite active materials by *Hitachi Chemicals* and *HC Carbon* is gratefully acknowledged.

*presenting author, email: marcus.mueller@kit.edu

KIT – University of the State of Baden-Wuerttemberg and
National Research Center of the Helmholtz Association