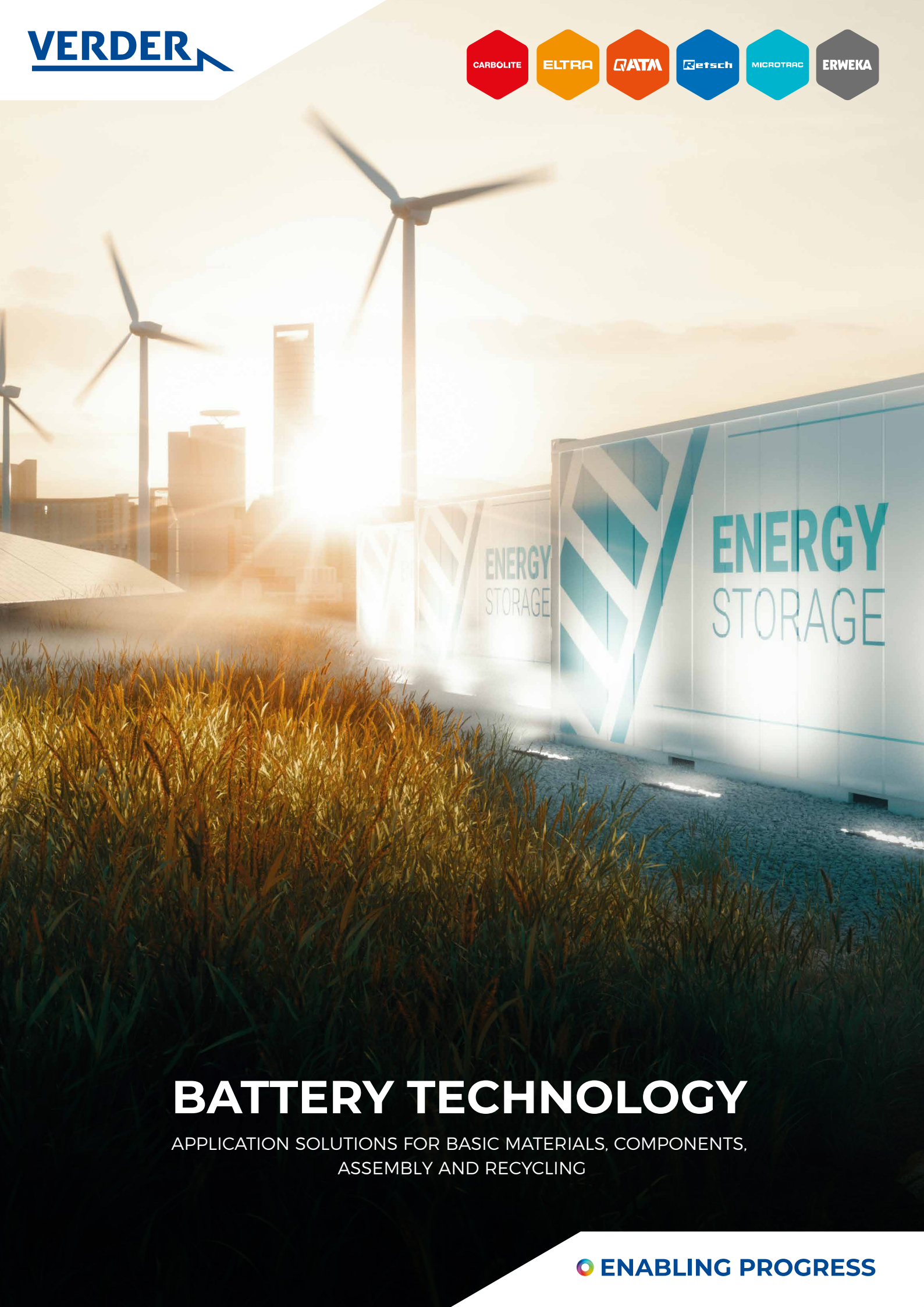




# BATTERY TECHNOLOGY

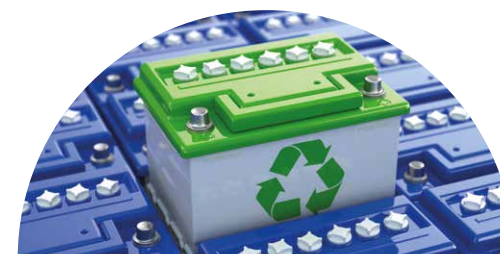
APPLICATION SOLUTIONS FOR BASIC MATERIALS, COMPONENTS,  
ASSEMBLY AND RECYCLING



## BASIC MATERIALS



## COMPONENTS



## ASSEMBLY & RECYCLING



DISCOVER MORE



ELEMENTAL  
ANALYSIS

- | Nitrogen & oxygen analysis of silicon nitride
- | O/N/H analysis of battery metal powders for cathodes
- | C/S analysis of graphite and carbon black
- | Sulfur screening in battery-grade copper
- | Carbon analysis of polymer separators

- | O/N/H analysis of cathode precursors and coated foils for oxidation state and moisture control
- | Carbon analysis of binders and composite slurries
- | Quality control of Cu/Al current collector foils via oxygen and carbon screening
- | Monitoring of residual sulfur in electrode slurries to prevent corrosion and performance losses

- | Carbon & Sulphur analysis of lead components
- | C/S determination in byproducts like slag



MATERIALOGRAPHY  
& HARDNESS TESTING

- | Investigation of lithium metal oxide particles

- | Cross-sectioning of electrode coatings
- | Hardness testing of welded tabs & collector foils
- | Microstructure analysis of solid-state electrolytes
- | Surface preparation of Cu/Al collector foils

- | Cutting of lithium-ion batteries
- | Mounting of lithium-ion batteries
- | Grinding and polishing of lithium-ion batteries
- | Hardness testing of electrode coatings, welds, and casings in li-ion cells



MILLING  
& SIEVING

- | Crushers and mills to prepare ores for analysis
- | Mechanochemical synthesis of novel solid electrolytes

- | Ball mills with temperature for all-solid-state battery components
- | Ball mills to pulverize and mix electrode material
- | Particle size analysis of battery materials by sieving
- | Precision milling of silicon for high-capacity anodes
- | Advanced milling for graphite electrode optimization

- | Sample preparation for elemental analysis and xrf
- | Preserving crystalline phases for xrd analysis
- | Shredding and sieving of battery material for segregation
- | Cryogenic homogenization of polymeric battery recycling fractions
- | Pulverization of electrode foils for quality and recycling studies



PARTICLE  
CHARACTERIZATION

- | Process-related particle measurement electrode slurry stability & homogeneity analysis

- | Particle size and shape of electrode materials, electrolytes and separators
- | Gas pycnometers to measure the density of electrode materials
- | Surface area and pore size distribution of electrode materials
- | Porosity of electrode and separator materials



HEAT  
TREATMENT

- | Calcination of cathode precursor powders
- | Thermal purification of graphite
- | Controlled-atmosphere processing of solid-state electrolytes
- | LOI testing of lithium ores
- | Sintering of ceramic electrolyte materials

- | Thermal processing of carbonaceous material at up to 3000 °C to produce high-quality electrode material

- | Thermal processing of recycled battery materials to extract reusable elements



## FROM THE COMPONENTS TO THE BATTERY



**BASIC MATERIALS**  
**METALS, GRAPHITE & POLYMERS**  
NITROGEN & OXYGEN ANALYSIS  
MATERIALOGRAPHIC PREPARATION  
SAMPLE PREPARATION  
PARTICLE CHARACTERIZATION



**COMPONENTS**  
**ELECTRODE POWDERS,  
ANODES & CATHODES,  
ELECTROLYTES & SEPARATORS**  
BALL MILLING  
PARTICLE CHARACTERIZATION  
SURFACE AREA,  
PORE SIZE DISTRIBUTION  
THERMAL PROCESSING



**ASSEMBLY**  
**BATTERY UNITS & PACKS**  
MATERIALOGRAPHIC  
SAMPLE PREPARATION  
MICROSTRUCTURE ANALYSIS  
CARBON & SULFUR ANALYSIS



**RECYCLING**  
**VALUABLE MATERIALS**  
SHREDDING OF BATTERIES,  
FRACTIONIZING BY SIEVING  
ELEMENTAL ANALYSIS  
HOMOGENIZATION  
ONLINE PARTICLE ANALYSIS  
THERMAL TREATMENT

## ENABLING PROGRESS



# VERDER

GLOBAL REACH, LOCAL EXPERTISE

|                                                                                                                         |                                                                                                                             |                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>HEAT<br/>TREATMENT</b>        | <br><b>ELEMENTAL<br/>ANALYSIS</b>        | <br><b>MATERIALOGRAPHY<br/>&amp; HARDNESS TESTING</b> |
| <br><b>MILLING<br/>&amp; SIEVING</b> | <br><b>PARTICLE<br/>CHARACTERIZATION</b> | <br><b>PHARMACEUTICAL<br/>TESTING</b>                 |



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