

ELECTRIC
VEHICLE
BATTERY

Li-Ion

HIGH-PERFORMANCE BINDERS FOR LI-ION BATTERIES

WATER-BASED SBR BINDERS FROM
SYNTHOMER

SYNTHOMER: EXPERIENCED AND FUTURE-PROOF

HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER



■ The Right Chemistry

- 50+ years experience in SBRs & acrylics
- William Blythe brand inorganic specialities
- High performance anode battery binders now available

■ Always Innovating

- R&D employees in state-of-the-art facilities
- Collaborations with electrochemical specialists

- Products for your battery needs in the *future*

■ Quality & Responsibility

- SBR binders made in Europe, available globally
- ISO 9001, 14001, 45001 accreditation
- Ecovadis Silver environmental, sustainability & CSR certifications



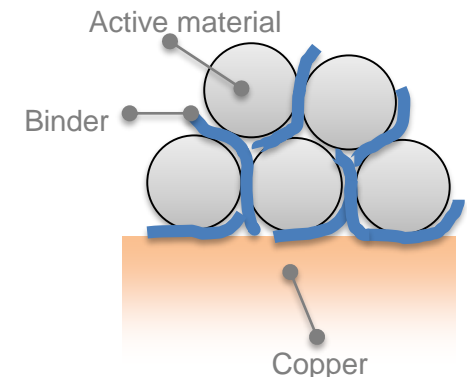
FTSE4Good

SBR AS THE CHOICE FOR WATER-BASED ANODES

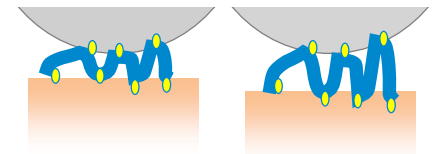
HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER



- SBR gives excellent adhesion to copper and active material
- High slurry homogeneity, wettability and coating
- Efficiency of SBR binder enables high battery performance and capacity
- Mechanical properties suitable for graphite and silicon
- High total capacity and good capacity retention

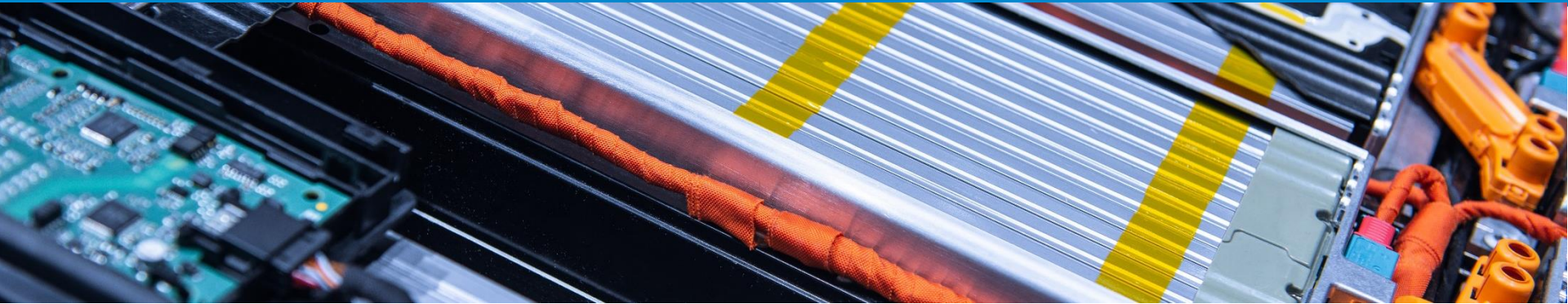


Adhesion maintained during charging & discharging



LITEX SBR BINDERS

HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER



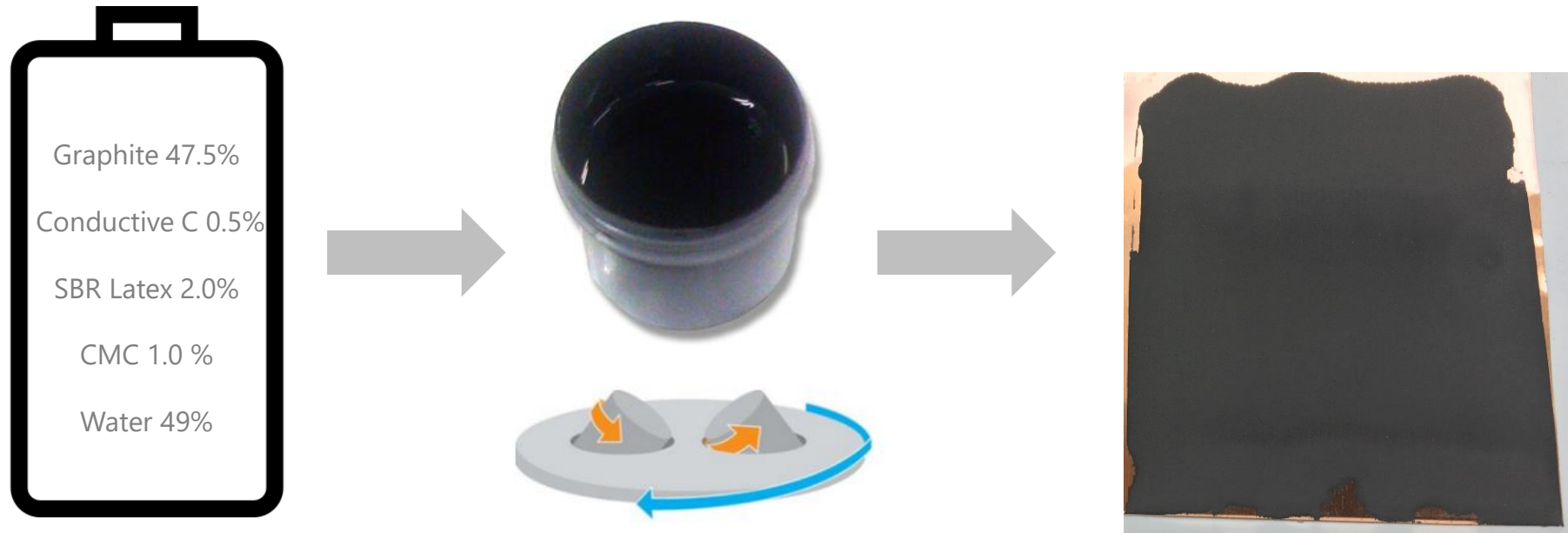
| Product Name | Chemistry | T _g (°C) | TSC (%) | pH |
|--------------|-----------|---------------------|---------|-----|
| LITEX LB-420 | SBR | 11 | 46 | 7.0 |
| LITEX LB-422 | SBR | -10 | 46 | 7.0 |

Values in the table are typical and should not be taken as a specification

- Synthomer SBR binders are supplied in a ready to use aqueous latex (46% solids)
- LITEX™ LB-420 for low resistance, high adhesion
LITEX™ LB-422 optimized for cold temperature environments

TYPICAL ANODE SLURRY FORMULATION

HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER

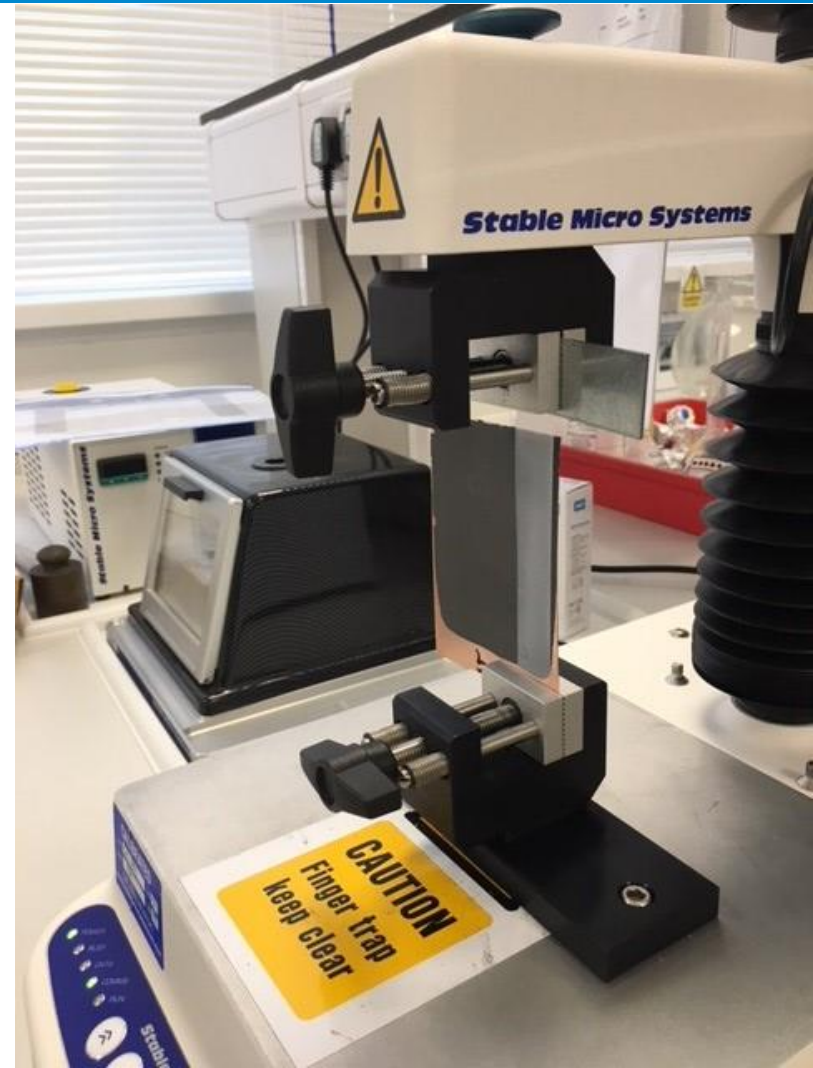
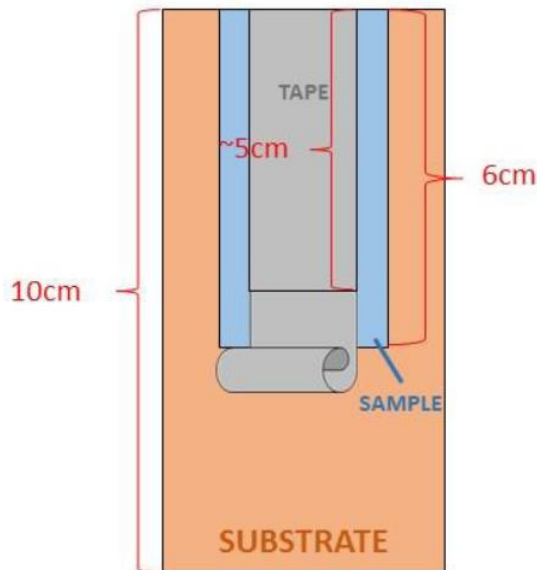


- High formulation flexibility thanks to excellent compatibility with other anode slurry materials
- SBR is typically used with carboxymethylcellulose thickener
- Mix using industry standard mixing equipment

ELECTRODE ADHESION IN 180° PEEL TEST

HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER

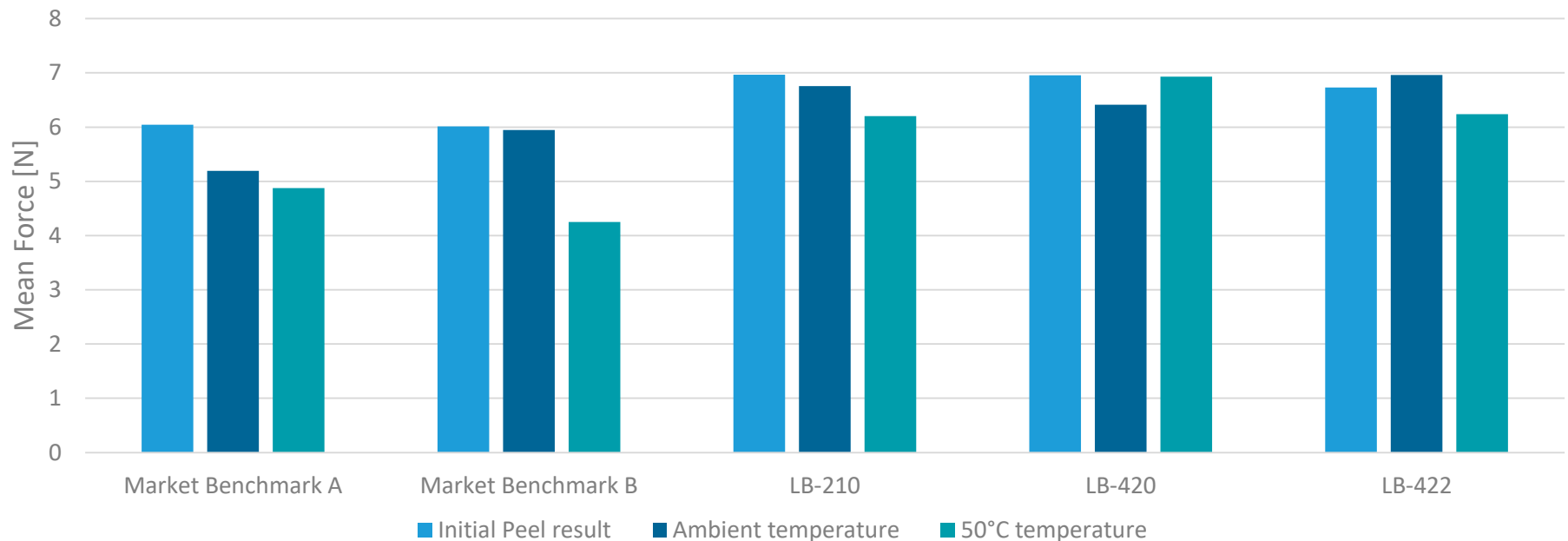
- Parameters in the 180° Peel Test
 - Electrode slurry cast on copper
 - 19 mm tape applied to dry film
 - Tape compressed with 2 Kg roller
 - Tape peeled by TA.XT Texture Analyser



SUPERIOR ELECTROLYTE RESISTANCE

180° PEEL TEST AFTER ELECTROLYTE IMMERSION

Peel Strength after Immersion in Electrolyte Solvent

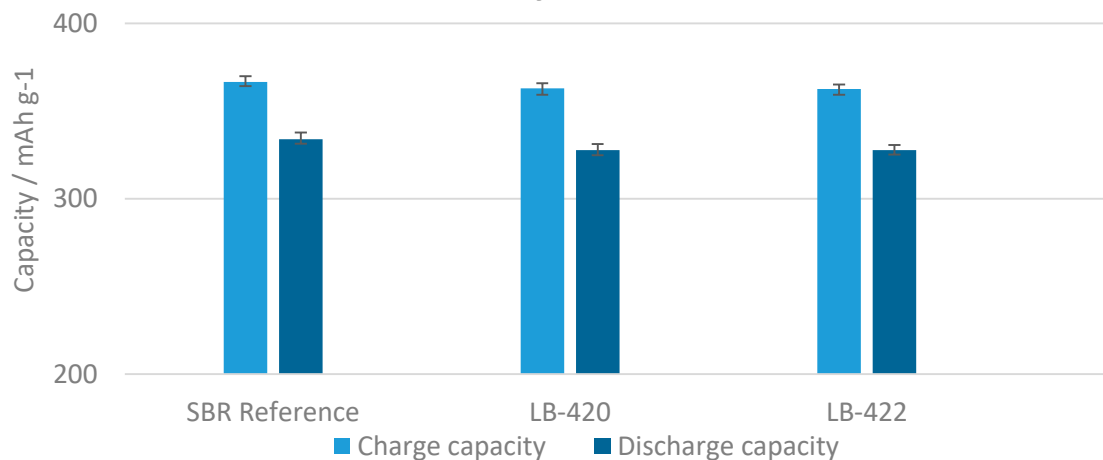


- Samples of electrode film soaked (6 h) in dimethyl carbonate electrolyte solvent
- Electrodes dried & peel strength measured
- **Superior adhesion, temperature resistance & electrolyte compatibility with LITEX LB**

ELECTROCHEMICAL PERFORMANCE

LITEX LB COMPARED TO SBR MARKET LEADER

Full-cell: 1st cycle Performance



Tested by 3rd party cell manufacturer

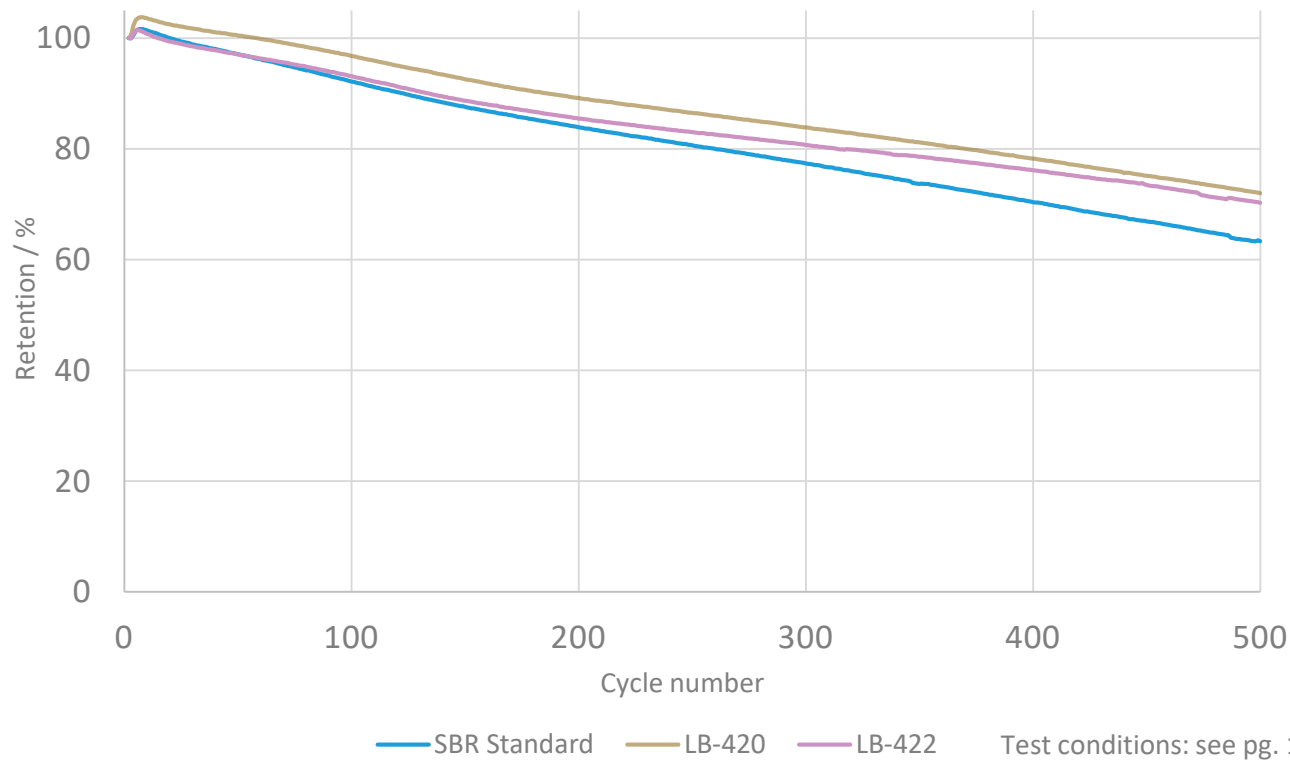
| | Charge capacity (mAh g ⁻¹) | Discharge Capacity (mAh g ⁻¹) | First Cycle Loss (%) |
|---------------|--|---|----------------------|
| SBR Reference | 367 | 334 | 91.1 |
| LB-420 | 363 | 328 | 90.3 |
| LB-422 | 363 | 328 | 90.4 |

- Cell format: 2032 full-cell coin
- Anode composition: Gr : Conductive C: CMC : SBR = 95 : 1 : 2 : 2 wt%
- Cathode composition: Lithium Cobalt Oxide
- Anode calendaring: Applied, VD: 1.61 ~ 1.66 g cm⁻³
- Test Conditions: C/25 for formation & C/2 for cycling

KEEPING THE ORIGINAL CAPACITY FOR LONGER

ELECTROCHEMICAL PERFORMANCE

Full-cell Cycle Retention



| | Capacity Retention (%) (2nd cycle = 100%) | |
|---------------|--|-----------|
| | Charge | Discharge |
| SBR Reference | 367 | 334 |
| LB-420 | 363 | 328 |
| LB-422 | 363 | 328 |

- Synthomer SBR binders ensures best retention of original capacity

LEADING PERFORMANCE TODAY AND TOMORROW

HIGH PERFORMANCE ANODE BATTERY BINDERS FROM SYNTHOMER



- Range of high-performance SBR binders available
 - Formulation flexibility & ease of use
 - Outstanding electrode adhesion & electrolyte resistance
 - Excellent electrochemical properties for long-term capacity retention

- Continued R&D into next generation systems such as silicon-based technology