bondwell™ cmc binders

easy-to-use binders ensuring the integrity of your lithium ion batteries

description

Ashland is the premier supplier of carboxymethylcellulose (CMC) binder technology for lithium ion battery anodes. Typically used in conjunction with styrene butadiene (SB) latex, naturally-derived Bondwell™ binders are renowned in the lithium ion battery industry for their usability, integrity and sustainability:

usability

- fast dissolution for ease of processing
- high viscosity at low shear to prevent SB latex migration during slurry coating process
- low viscosity at high shear for easy mixing and coating
- compatible with industry standard materials including natural- and synthetic-graphite

integrity

- high quality CMC to eliminate electrode defects
- superior capacity retention for cell integrity
- strong rate performance for power applications

sustainability

Bondwell CMC binders contain at least 77% renewable carbon*.

All Bondwell™ binders are fluorine-free, enabling use of water-based formulations for solvent-free, zero-VOC formulations.

Ashland offers two standard grades of bondwell™ cmc binders:

Bondwell™ BVH8 binder has lower viscosity for easier processing and a lower degree of substitution (DS).

Bondwell™ BVH9 binder has higher viscosity for improved slurry stability and a higher degree of substitution (DS).

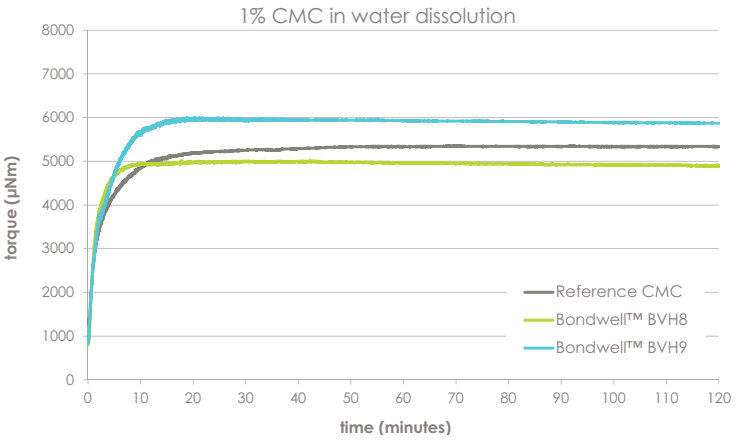
Bondwell™ CMC anode binders

product name	degree of substitution (DS)	viscosity (1% solution, cPs)[1]	pH	purity
Bondwell™ BVH8 CMC	0.80-0.95	800 - 1,200	6.5 - 8.5	>99.5%
Bondwell™ BVH9 CMC	0.90-1.05	2,000 - 4,000	6.5 - 8.6	>99.5%

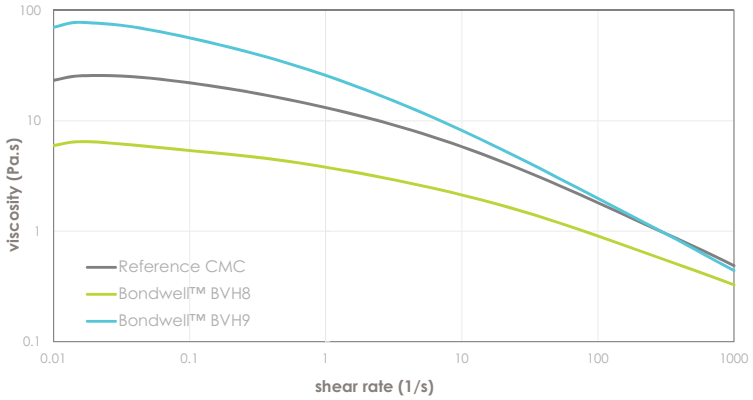
[1]Brookfield viscometer, LV type, spindle #4 at 30rpm at 25°C [2]purity, %, 100-(Na Glycolates + NaCl)

bondwell™ cmc anode binders for usability

Bondwell™ binders demonstrate fast dissolution for ease of processing



Bondwell™ binders with (i) high viscosity at low shear rate for stability and (ii) low viscosity at high shear rate for easier mixing and coating



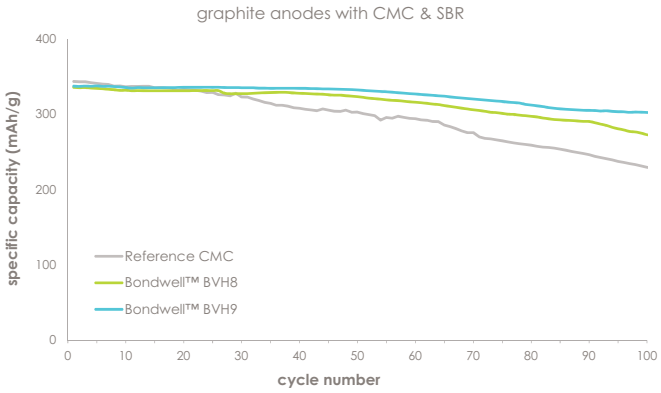
bondwell™ cmc anode binders for integrity

superior quality of Bondwell™ binders to prevent cell defects (typical values)

product name	moisture (%)[1]	particle size (D50 µm)[2]	number of gel particles[3]
Bondwell™ BVH8 CMC	4.7	56	15
Bondwell™ BVH9 CMC	5.1	51	19
reference CMC	7.5	101	21

[1] moisture analyzer
[2] laser diffraction particle sizer analyzer
[3] 1% solution of CMC, 100 µm thickness of wet drawdown, 5cmx5cm area

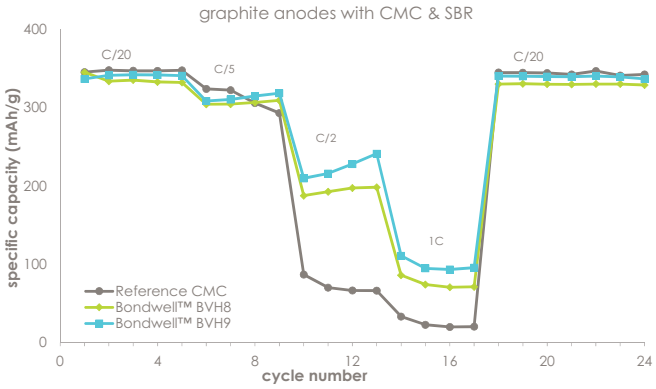
superior capacity retention of Bondwell™ binders for cell integrity



half coin cell: Areal loading: ~ 5 mg/cm2; Density: 1.5 g/cm3; Electrolyte: 1 M LiPF6 in EC/DEC/DMC.

test condition: Voltage cut-off 0.01V – 1.50V; Cycling rate: CC-CV at 0.2C-0.2C

strong C-rate performance of Bondwell™ binders for fast charging and discharging



half coin cell: Areal loading: ~ 5 mg/cm2; Density: 1.5 g/cm3; Electrolyte: 1 M LiPF6 in EC/DEC/DMC

test condition: Voltage cut-off 0.01V – 1.50 V; C-rates: CC-CC at 0.05C, 0.2C, 0.5C and 1C

bondwell™ cmc binders for sustainability

Bondwell™ BVH9 CMC consists of 77 % renewable carbon*
Bondwell™ BVH8 CMC consists of 78 % renewable carbon*

*These water-soluble polymers are derived from cellulose. The % renewable carbon has been calculated based on the cellulose and the average substituent level; it reflects the percentage of carbon from cellulose relative to the total amount of carbon in each of these products.

regional offices

North America
Bridgewater, NJ USA
Tel: +1 877 546 2782

Latin America
Mexico City, Mexico
Tel: +52 55 52 76 6121

Europe
Schaffhausen, Switzerland
Tel: +41 52 560 55 00

Asia Pacific
Singapore
Tel: +65 6775 5366

Shanghai P.R. China
Tel: +86 21 6090 6606

Tokyo, Japan
Tel: +813 55668705

Seoul, Korea
Tel: +822 554 6622

Middle East, Africa & India
Dubai, U.A.E
Tel: +971 4 393 2431

Maharashtra, India
Tel: +91 22 6282 8700

ashland.com/contact

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