

Bindzil GB

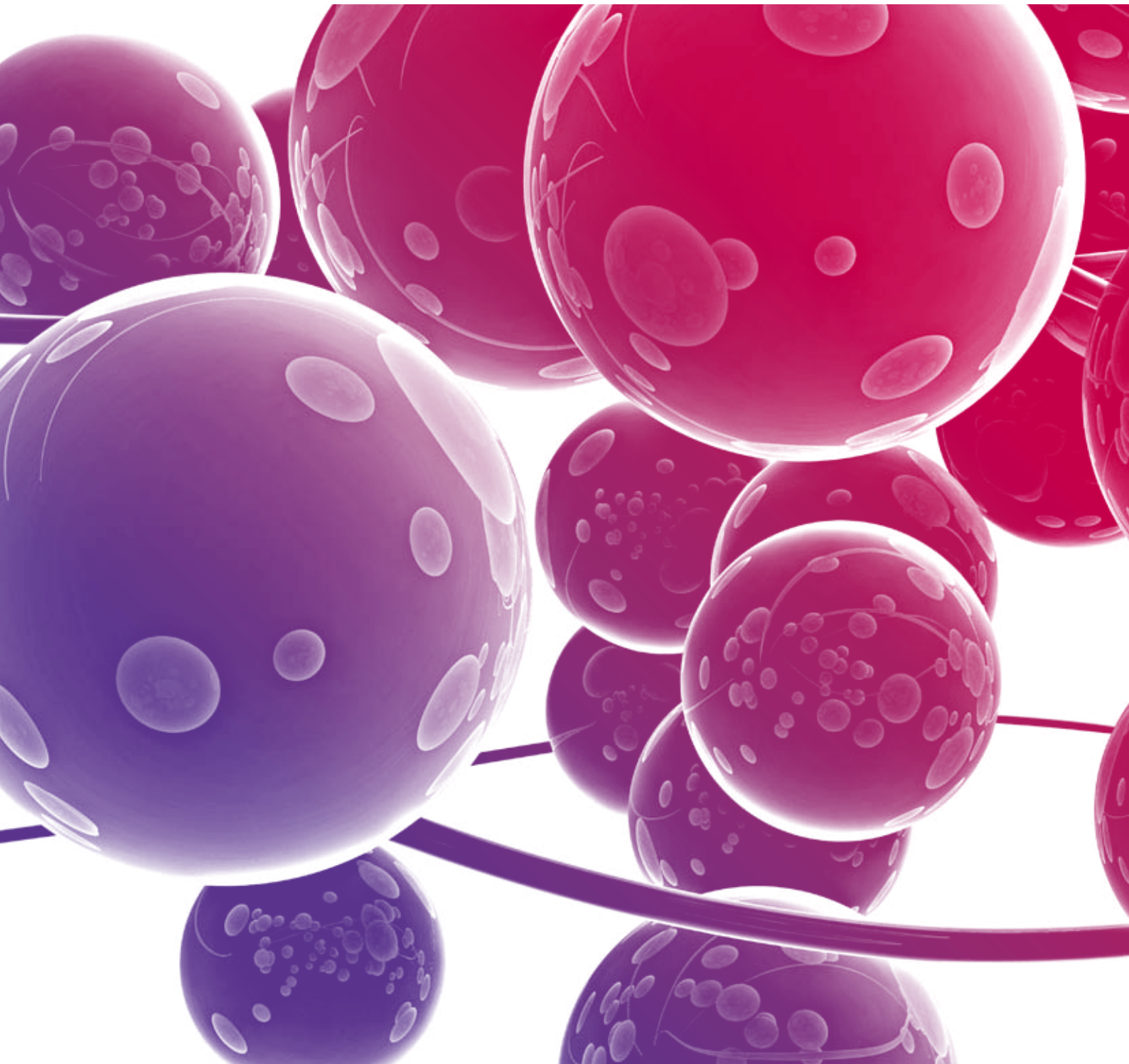
colloidal silica dispersions

For the lead-acid battery industry



AkzoNobel

Tomorrow's Answers Today



Functions and benefits

Bindzil colloidal silica dispersions are used for gelling the sulphuric acid, i.e. for obtaining a solid electrolyte in the battery. Bindzil products perform the following functions in the battery:

- **Gelling – solidifying the electrolyte**
- **Gel cracking – enabling oxygen transport**

Benefits

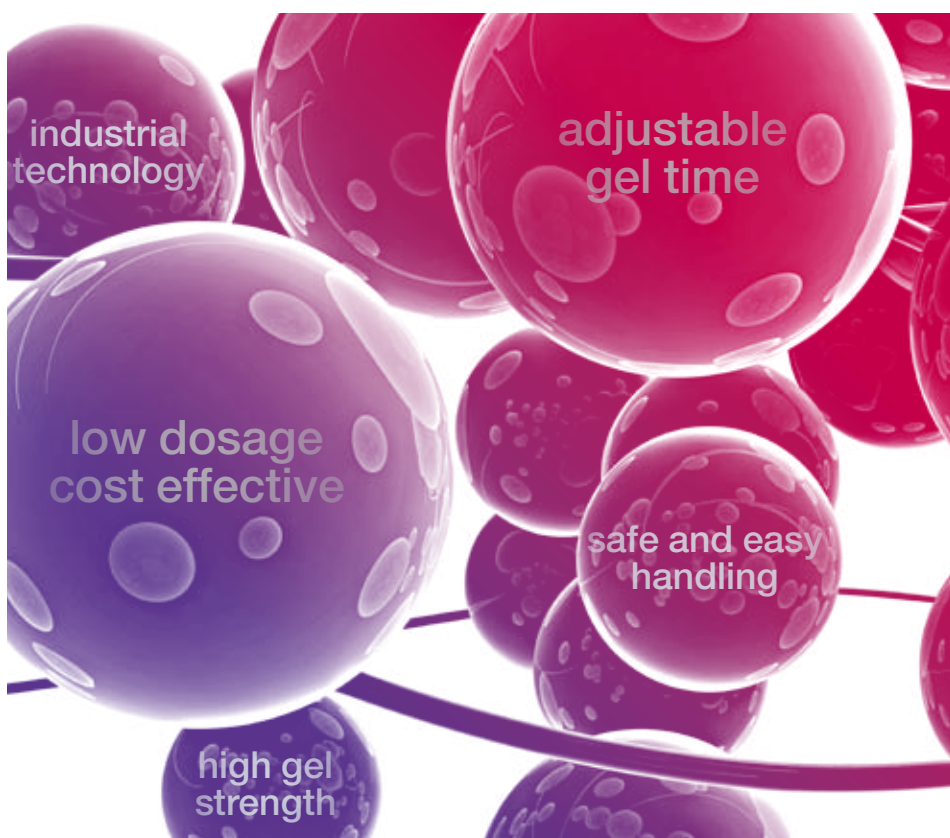
- Water-based with low viscosity
- Low dosage – cost effective
- Vacuum filling not required
- Low impurities – high electrical capacity
- Adjustable gelling time
- Safe handling
- Is mixed directly with sulphuric acid before filling the battery without prior pre-treatment

Product recommendations

Bindzil GB1000, GB200 and GB3000 are used as gelling agent in the lead-acid battery industry to solidify the acid utilising an in-line mixing unit designed for Bindzil GB products.

Bindzil GB1000 and GB2000 containing less water are preferably applied to minimise the heat development.

Bindzil GB3000 is recommended when high gel strength combined with lower impurities is the most wanted performance profile.



Properties of Bindzil GB

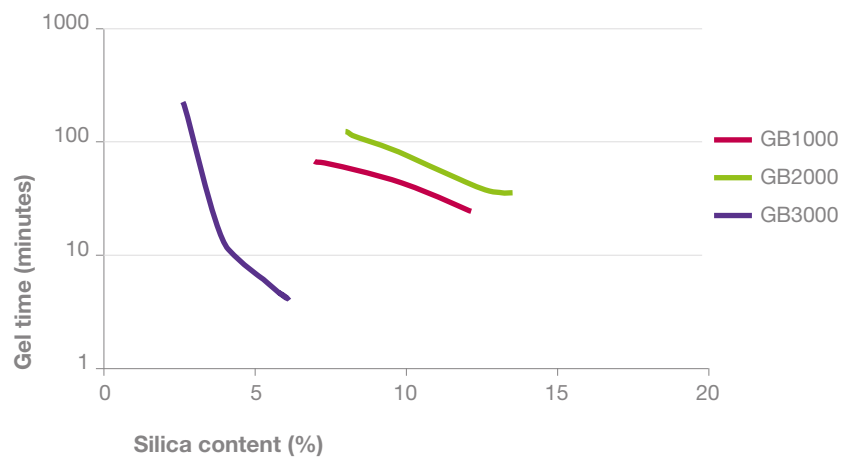
Specific parameter	Unit measure	Bindzil grades		
		GB1000	GB2000	GB3000
Density	g/cm ³	1.2	1.3	1.1
SiO ₂	wt %	30	40	15
pH	---	10.5	10.4	10.5
Viscosity	mPas	8	19	10
Na ₂ O	wt %	0.6	0.5	0.8

Bindzil GB technology to solidify your battery

Gel time

An increase in silica dosage will render a shorter gel time and an increase in gel strength. An increase in temperature by 10 °C will double the rate of gelling, which means a reduction in gel time by 50%. In the same manner, a decrease in temperature by 10 °C will reduce the rate of gelling by 50%, therefore doubling the time required to obtain a solid gel.

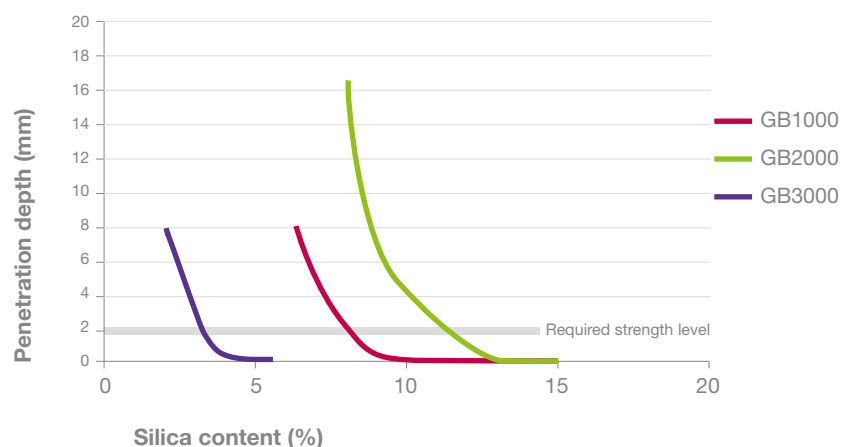
Gel time as a function of Bindzil GB dosage sulphuric acid 38 % by weight



Gel strength

Bindzil GB particles generate fast development of siloxane bridges and the gel will become rigid and therefore not re-dispersible. Colloidal silicas with bigger particles require a higher dosage for achieving the same gel strength as silicas with smaller particles. Higher silica content creates a higher gel strength. Bindzil GB3000, having an unique particle configuration, creates a strong gel at a much lower silica concentration. A lower solid content improves the electrical performance of the battery.

Gel strength as a function of Bindzil GB dosage sulphuric acid 38 % by weight



Bindzil GB product line

industrial in situ mixing

Formulation and application guidelines

Bindzil GB does not need to be pre-treated as the fumed silica. The water-based Colloidal dispersions can be easily mixed with the sulphuric acid of filling concentration. The products should be well mixed, preferably by an in-line mixer, and then directly filled into the battery. Additives such as e.g. phosphoric acid could be pre-mixed with the colloidal silica but have to be used within a short time since storage stability will be lost. If the Bindzil GB products are to be used together with other additives, evaluations of the compatibility of the Bindzil GB products and the additives have to be performed in advance.

A dosage of about 3 to 10 % SiO_2 of the total weight is recommended to give sufficient gel strength in sulphuric acid of densities from about 1250 to about 1400 g/dm^3 . Bindzil GB3000 will give a higher gel strength based on dry weight compared with Bindzil GB1000 and Bindzil GB2000; however, on a product basis the dosage will be similar. Bindzil GB2000 with a silica content of 40% by weight are recommended in situations where it is important to minimise the heat development during mixing (due to dilution of the sulphuric acid with water). Bindzil GB grades have narrow particle distribution with a unique configuration giving high gelling efficiency.

Manufacturing equipment

In-line filling is the preferred route since mixing of colloidal silica and sulphuric acid should never take longer than one minute due to possible damage of gel structure.



Bindzil GB technology

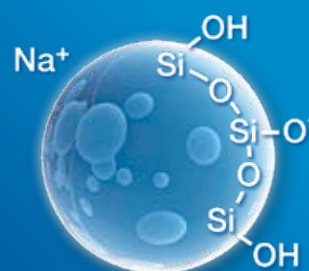
solidifying of the electrolyte

-gelling mechanism

Bindzil GB colloidal silica

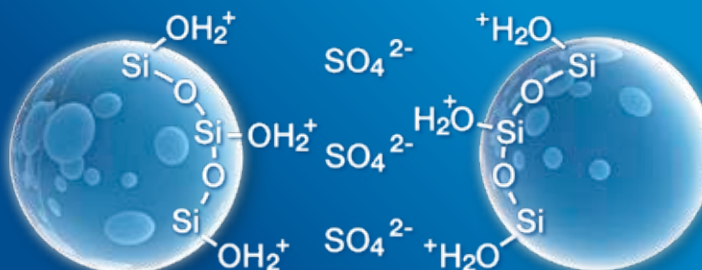
Aqueous, amorphous colloidal silica dispersion

- Anionic particles
- Sodium stabilized
- Dispersed in water
- pH 8–11



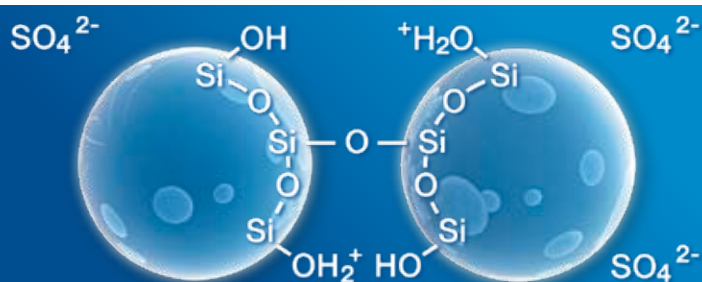
Aggregation

To obtain siloxane bridges between the silica particles, it is essential to have the particles close to each other. This is done by aggregation of the particles. The silica particles are positively charged in a water-based system below pH 2 and will aggregate using the negatively charged sulphate ion as a gel activator.



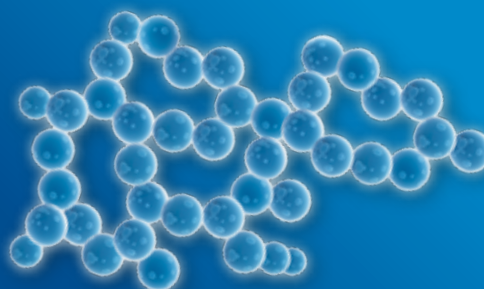
Creation of a gel

The aggregation of particles and the gelling of the colloidal silica starts immediately. Typical time for the gel to reach a solid state for Bindzil GB2000 in sulphuric acid of the density of 1.30 kg/dm³ is about 40 to 50 minutes at a silica concentration of 10% based on the total weight at room temperature.



Gel structure

Illustration of the formation of an irreversible three-dimensional gel structure.



Further information

For more detailed product information, please refer to the separate product guide. For samples, technical service and further information, please contact your nearest office, visit our website at www.colloidal silica.com, or send an e-mail to colloidal silica@akzonobel.com

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