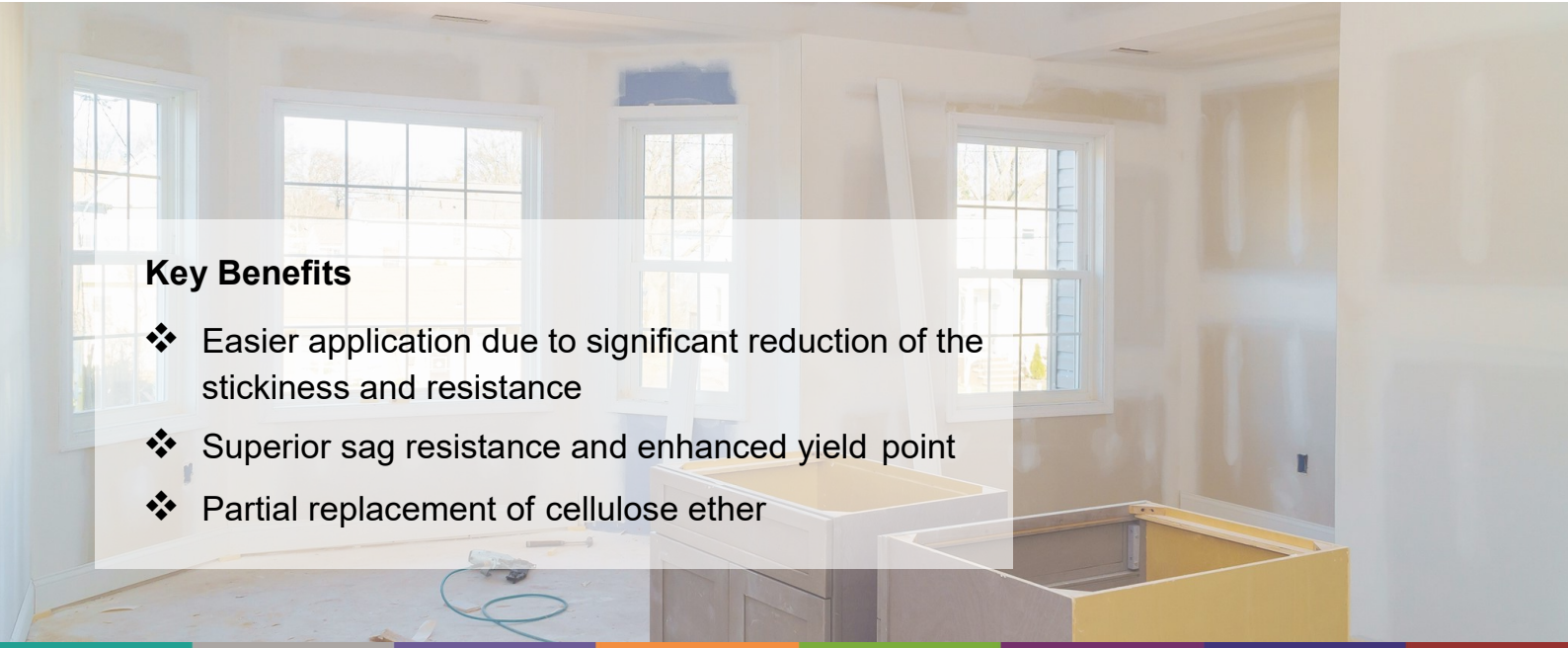


BENTONE[®] GS

Clay based rheology modifier for emulsion based joint filler compounds



Key Benefits

- ❖ Easier application due to significant reduction of the stickiness and resistance
- ❖ Superior sag resistance and enhanced yield point
- ❖ Partial replacement of cellulose ether

Introduction

Emulsion based, pasty joint filler compounds are designed to fill and finish the joints between edge-bevellued plasterboard after installation. Joint filler compounds are typically applied in several layers. To achieve a perfect final result of the wall, a reinforcing paper strip is applied in the gap. These procedure ensures endurance of the gap coverage as it distributes tension forces, caused by e.g. temperature differences, over the entire surface. After covering the joints and curing of the filler, the surface is being sanded to remove any imperfections and to obtain a smooth surface. This ensures an optimum surface quality for the following decorative working steps, e.g. application of paint and/or wallpaper.

To adjust consistency and the water household of the system, typically cellulose ethers are formulated. However, an unwelcome side effect of cellulose ethers that they cause poor workability by low slip and strong tackiness on the tool. To reduce stickiness and to improve the workability certain clay based rheological modifiers, such as BENTONE® GS, are being formulated as partial replacement for cellulose ether.

As these kind of renderings are applied by hand, using a trowel, the lowest stickiness on the tool and resistance is desirable. Additionally to the resulting optimized workability, BENTONE® GS causes significantly enhanced sag control. Further, BENTONE® GS does neither affect the bonding strength to the paper strip nor to the plasterboard.

Composition	Highly beneficiated smectite clay
Color/Form	Milky-white, soft powder
Solids content , [%]	100
Apparent (bulk) density, [g/cm ³]	0.4
Particle size < 200 µm , [%]	25

Key benefits

- Possibility to be used as a partial replacement to typically formulated cellulose ether
- Easier application due to reduced resistance and stickiness
- Excellent sag and slump control
- Increased yield point
- Optimised surface appearance due to enhanced slip

Incorporation and levels of use

BENTONE® GS are typically added to the normal processing of the joint filler compound. It is recommended to wet out and mix the clay with pure water prior the addition of further components. It will be fully activated during the dispersing process at the highest possible shear.

Typical levels of use for BENTONE® GS is between 0.1% and 0.5%. However, the finally required amount will depend on the system and on which cellulose ether is used.

Test system

Compound	Concentration [%]
Water	18.0 - X
Propylene glycol	1.2
NUOSPERSE® FX 605	0.3
Defoamer	0.6
Preservative	0.2
Rheological additive	X
Dolomite extender	73.6
Styrene-acrylic binder emulsion	6.0
Total	100.0

X is variable in accordance with individual concentration.

Sample preparation

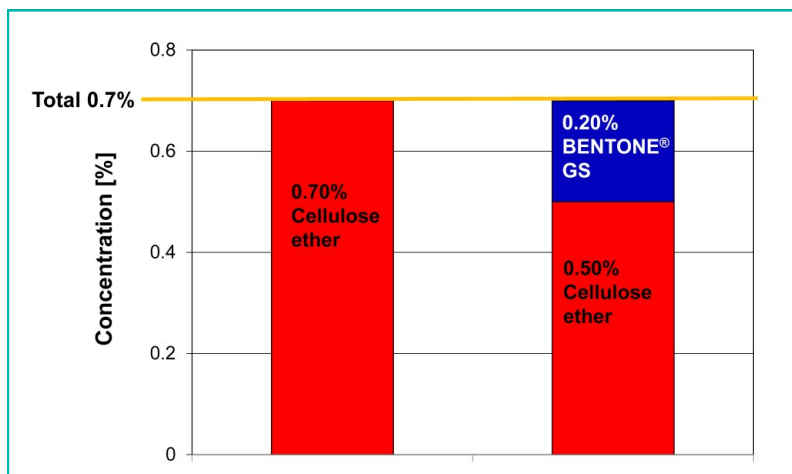
- Put the water portion into the mixing vessel positioned under a tooth bladed cowles dissolver.
- Add the clay amount into the water under low agitation and mix for 5 minutes.
- Add all further components and grind as usual.
- The amount of defoamer should be added in two steps. The first portion should be added at the begin (after the clay), the second part at the end.

Practical examples

The use of BENTONE® GS as a partial alternative for cellulose ether is illustrated. The abbreviation CE indicates cellulose ether. The cellulose ether used was a standard ethyl hydroxyethyl cellulose.

Figure 1 : Loading level and viscosity build

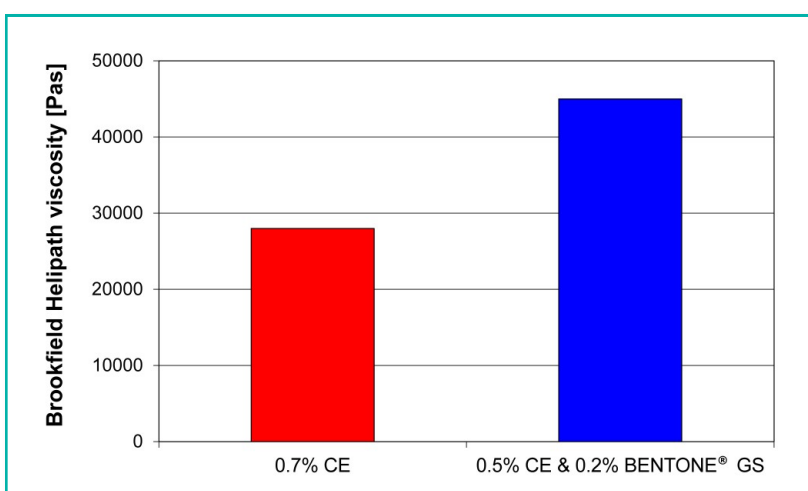
The figure 1 shows the additive concentrations required to achieve equal viscosity at mid-shear viscosity at a shear rate of 6.3 s^{-1} .



Both, pure cellulose ether and the combination of cellulose ether with BENTONE® GS, required equal total loading of 0.7% to achieve identical mid-shear viscosity. In these case approximately 28% of the original cellulose ether quantity have been replaced by BENTONE® GS.

Figure 2 : Brookfield Helipath viscosity

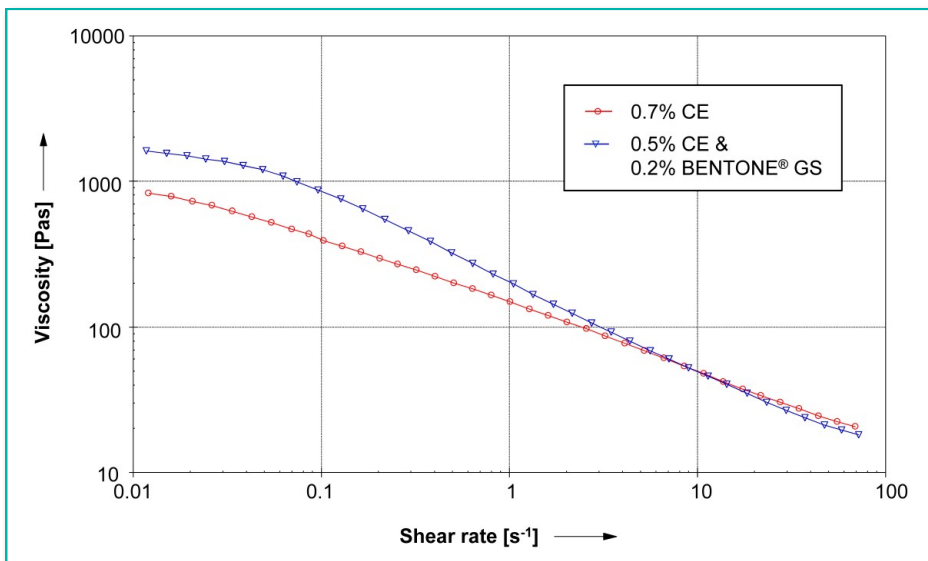
The viscosity at lower shear rates was determined using the Brookfield Helipath viscometer. The abbreviation CE indicates cellulose ether.



The sample containing cellulose ether in combination with BENTONE® GS demonstrated significantly higher viscosity at lower shear rates than the original sample formulated with pure cellulose ether.

Figure 3 : Rheograms

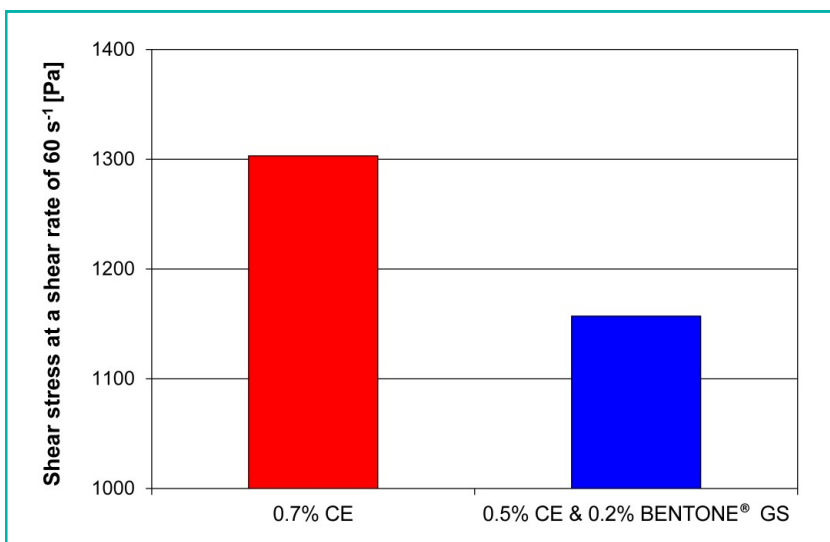
Rheological data have been determined using the Anton-Paar MCR 300 rheometer, equipped with the BM 15 measuring geometry, at a temperature of 23°C.



The sample modified with 0.2% of BENTONE® GS displayed significantly higher viscosity at low-shear rates. Also the shear thinning character of these sample is noticeably stronger than with pure cellulose ether.

Figure 4 : Shear stress at high-shear forces

The shear stress necessary to initiate a shear rate of 60 s⁻¹ is used as an equivalent for the energy required for the application. The lower the bar the better the result.

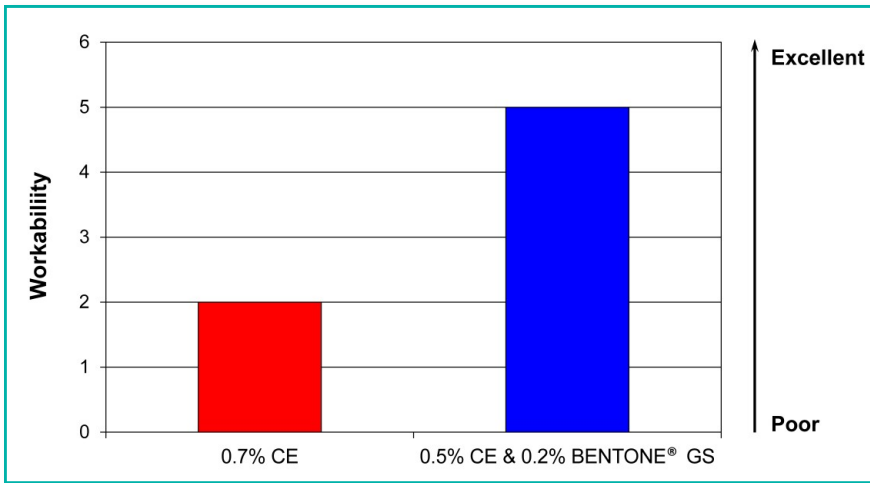


The sample containing BENTONE® GS required the lowest amount of energy to initiate flow at a shear rate of 60 s⁻¹. The sample formulated with pure cellulose ether required significantly higher force to initiate identical flow.

The data shown have been extracted from the rheological data curve above. The forces displayed are in line with the application properties which can be found on the following page.

Figure 5 : Application behavior

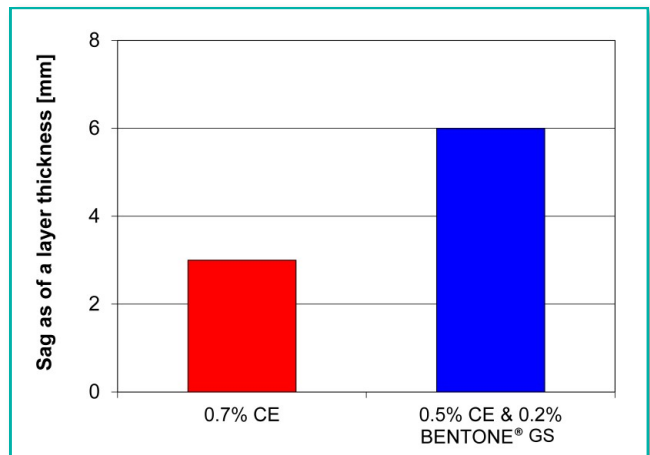
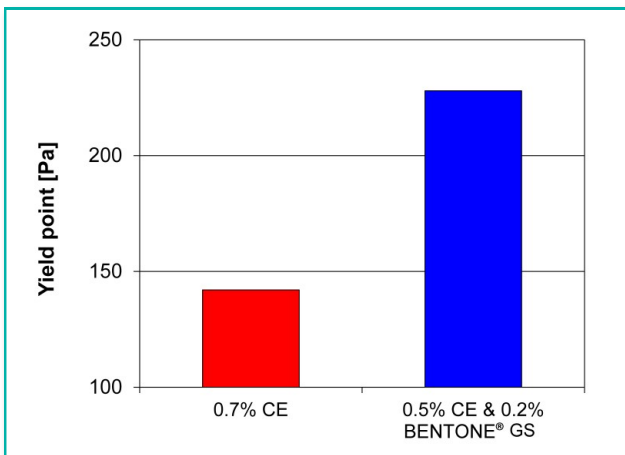
The application behavior was judged subjectively.



Partial replacement of cellulose ether with BENTONE® GS resulted in improved application properties and lower stickiness on the tool.

Figure 6 : Yield point and Figure 7 : sag/slump control

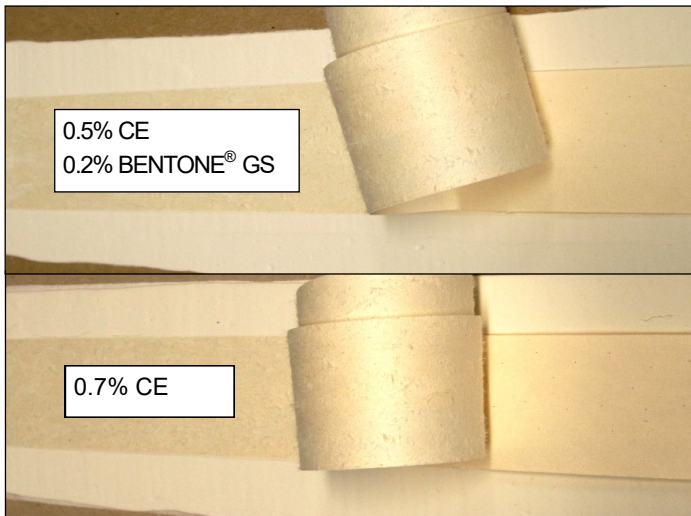
Sagging, noted as the maximum applicable layer thickness, has been tested upon wedge blade application. The yield points were evaluated by an Anton-Paar MCR 300 rheometer, in an amplitude sweep test. The yield point is the minimum force necessary to induce flow to the system.



The use of BENTONE® GS resulted in the highest sag stability and yield points compared to cellulose ether. This means, thicker layers could be applied and remain stable on the vertical surface.

Figure 8 : Adhesion test

The adhesion of the adhesive to an reinforcing paper strip and the gypsum plasterboard substrate have been tested.



BENTONE® GS did not negatively affect the adhesion of the joint filler to a paper joint strip. In no case a break of the paper/joint filler interface was noticed.

Conclusion

BENTONE® GS formulated as a partial replacement for cellulose ether improved the workability of the joint filler system significantly. This was also emphasized by a much stronger shear thinning flow and a much lower shear stress required to initiate a higher shear force. Further, a strong enhancement of the sag resistance and the yield point was noticed with BENTONE® GS.

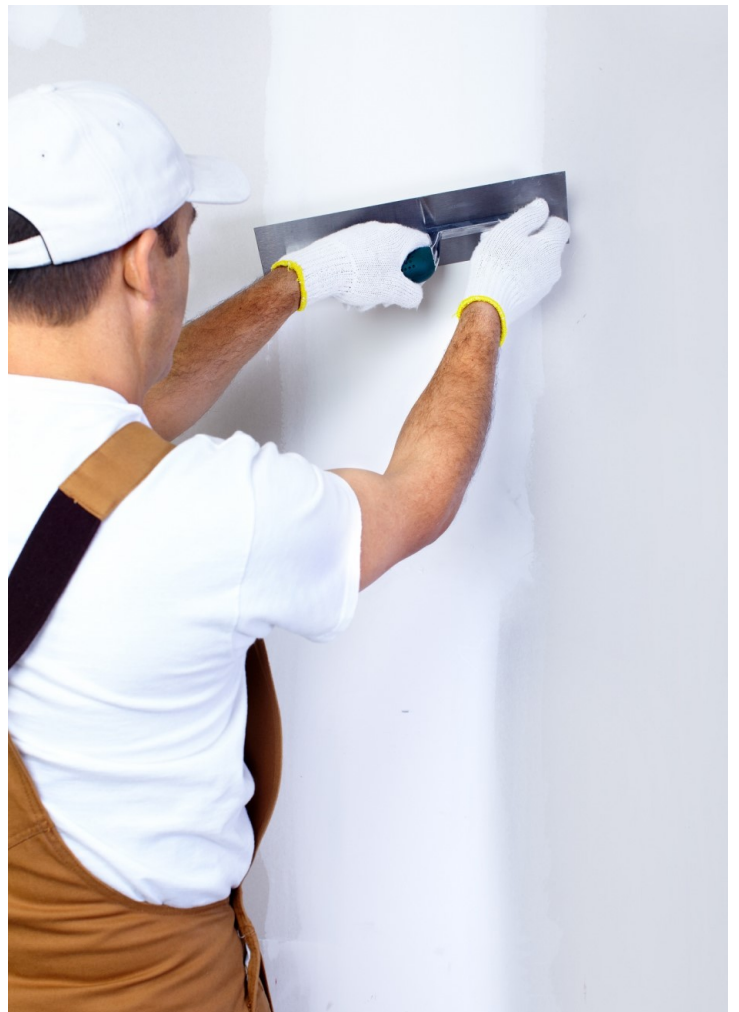
When using BENTONE® GS, no reduction of the adhesion strength of the joint filler compared to the sample - thickened only with cellulose ether - was observed.



Appendix

Test methods

- The viscosity at lower shear forces was measured using an Brookfield RVT viscosimeter, equipped with Helipath spindle E at 5 rpm and a temperature of 23 °C.
- To test the sag resistance the renderings were applied with a wedge shaped blade (0 - 3 cm height) on gypsum plasterboards and stored vertically until cured. The maximum film thickness without sagging was recorded.
- Yield point was determined with a Anton-Paar MCR 3000 rheometer, measuring geometry PP 25, at a temperature of 23 °C. The test was performed as an amplitude sweep. The end of the linear viscoelastic range was defined as the yield point of the system.
- Workability or application properties were evaluated by applying the rendering with a smooth trowel on a vertically positioned gypsum plasterboard. The stickiness on the tool and the force required during the application were subjectively assessed.
- Shear stress at high shear forces was determined with a Anton-Paar MCR 3000 rheometer, measuring geometry PP 25 plaster (spindle/beaker system; serrated surface), at a temperature of 23 °C



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