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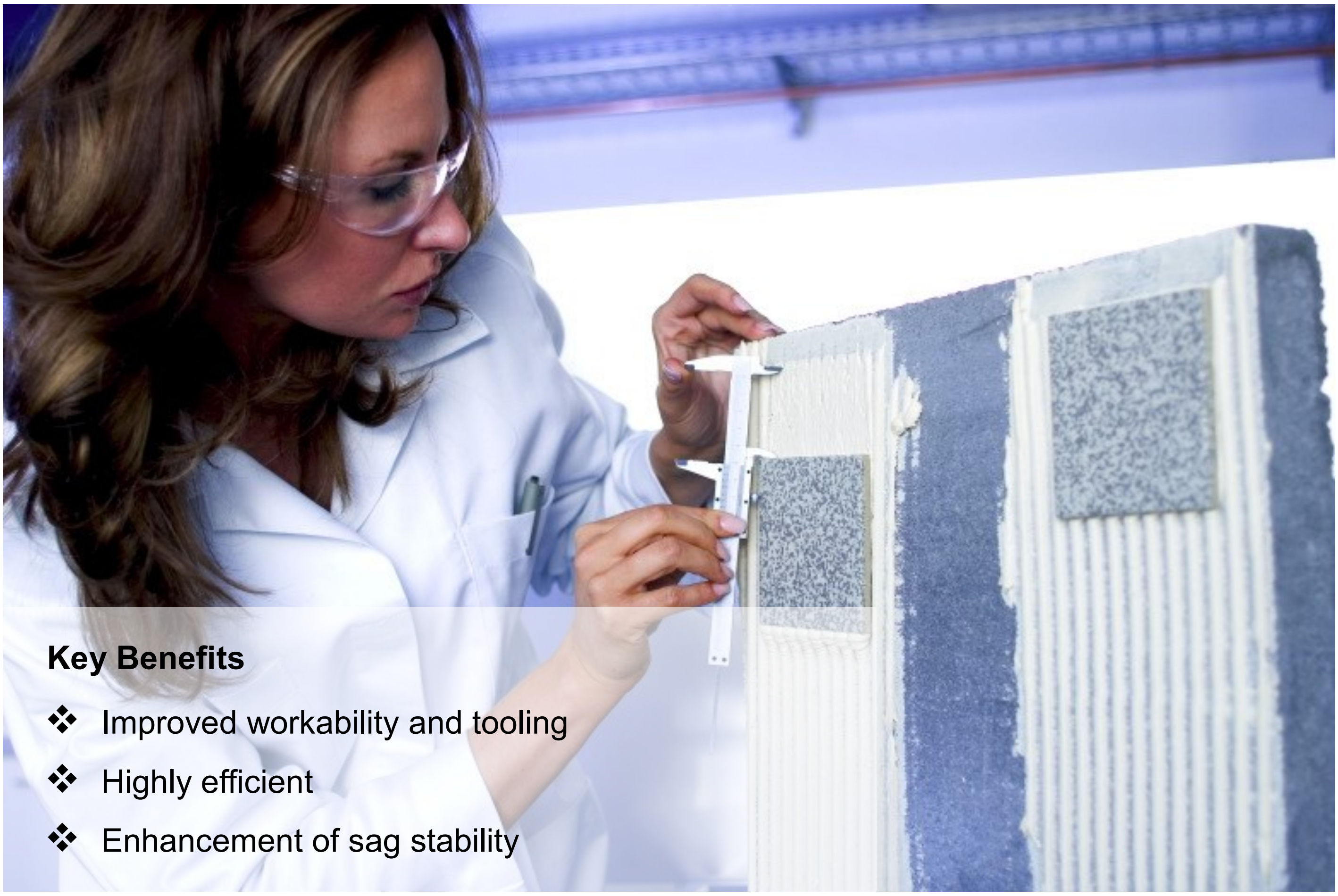
Application Leaflet

BENTONE® CT

Natural Hectorite grade as alternative to further clay types



Key Benefits

- Improved workability and tooling
- Highly efficient
- Enhancement of sag stability

Introduction

Mastic tile adhesives are pasty, emulsions based systems for tile bonding. Such systems are suitable for all substrates, including diffcult ones.

Typically, cellulose ethers and polyacrylic thickeners are used to control rheology, consistency, sag resistance and open time. However, the workability and the sag resistance of these additives are often not sufficient.

Clay based additive, e.g. BENTONE® CTare usually formulated in order to obtain the below benefits:

Benefits

- Optimized workability
- Enhanced sag stability
- Elongated storage stability
- Excellent water resistance

BENTONE® CT

Composition	Untreated natural Hectorite clay
Form	Free flowing, creamish powder
Particle size < 74 µm [%]	95
Density [g/cm³]	2.60

Performance study

BENTONE® CT showed better performance than other clay-based additives such as bentonite, attapulgite and sepiolite in the following study.

As initially mentioned, mastic tile adhesives are typically formulated with cellulose ether and the ASE based RHEOLATE® 125 as main thickeners. In the present study, the additional use of various clay grades are used to achieve the required viscosity of 200 Pas (at a shear rate of 5 s^{-1}).

The tested grades are the Hectorite based BENTONE® CT and three market reference grades based on bentonite, attapulgite and sepiolite.

The clay concentrations used to obtain the mentioned viscosity are shown in Figure 1.

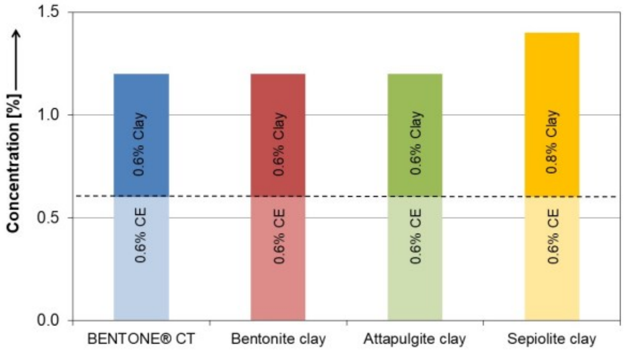


Figure 1: Effectivity

BENTONE® CT, bentonite and attapulgite require the same loading levels. The tested attapulgite clay requires noticeably higher loadings to achieve the target viscosity.

However, also the viscosity stability plays a major role in the formulation of emulsion based systems. The viscosity variations after 2 weeks of storage at elevated temperature of 50°C has been visualized in *Figure 2*.

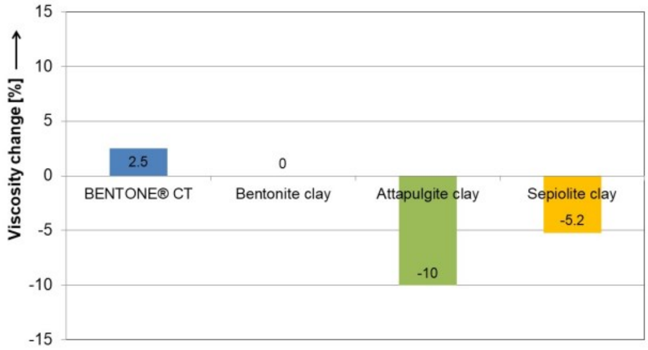


Figure 2: Viscosity stability

BENTONE® CT and and the bentonite clay provided stable viscosities. With attapulgite and sepiolite clay a noticeable viscosity loss was observed. In no case syneresis or sedimentation has been detected.

Also, clays are being formulated in order to enhance the so called yield point. High yield points are required to indicate the sedimentation stability and help to predict the sag control of the freshly applied tile.

The yield point can be detected by a constant increase of the shear stress. With increasing stress, the strain (deformation) is increasing as well.

In *Figure 3* the resulting data are shown. The plotted data show a flat slope of the curve at lower shear stress. In the upper shear stress range, the slope is running more steeply. In between, the flat and the steep part of the curve, a characteristic change of direction is noticed. This „kink“, is indicating the change in the flow characteristics. Whilst the flat curve indicates a elastic dominated character, the steep part indicates fluid conditions by a strong increase of the deformation.

A determination of the changing characteristics is typically performed by two mathematic regression. The first is taken of the flat, and the second on the steep part of the graph. An elongation of both regression lines are displaying a cross point. This crossover point shows the the yield point value when read of the shear rate scale.

In general, the higher the values are on the strain (deformation) scale, the higher the degree of deformation/flow will be.

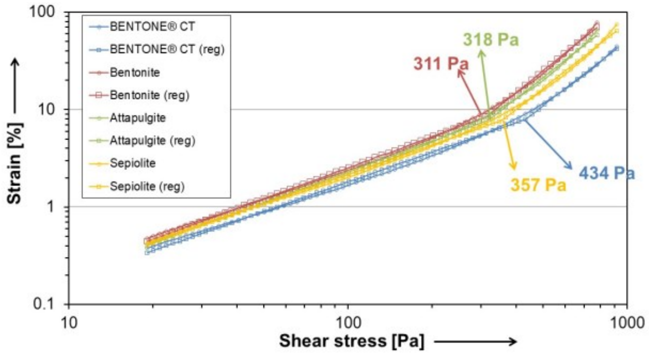


Figure 3: Rotational yield point detection

Reviewing the plotted data indicated, that the use of BENTONE® CT provides the highest yield points. The market references based on either bentonite and attapulgite are providing the lowest values. Sepiolite, acts in between.

In *Figure 4*, the sag stability of the adhesives equipped with various clays is visualized. The sag control has been determined a heavy tile into the wet adhesive bed positioned vertically. The shorter the slipping within a time frame of 20 minutes, the better the sagging stability.

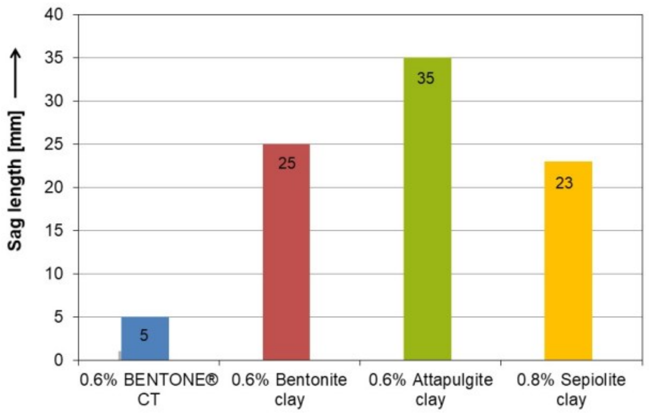


Figure 4: Sag stability

BENTONE® CT allows the shortest slip of tile and provides the highest sag stability.

The workability of the applied tile adhesives has been visualized in *Figure 5*.

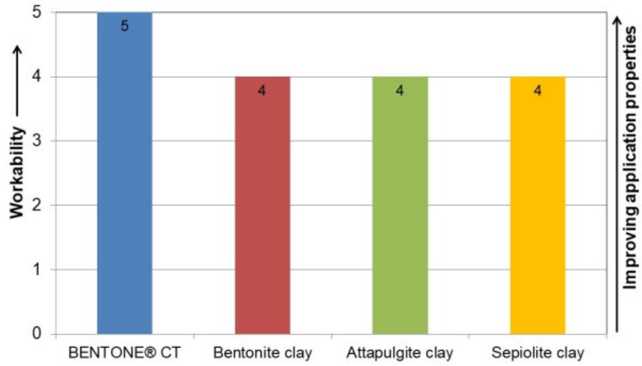


Figure 5: Ease of application

When applied by a serrated trowel, BENTONE CT gives the easiest feel and the lowest stickiness to the tool.

The open time of a tile is also of high importance. Longer open times are allowing the a more flexible application of the tile. Also more equal strength of the bonding is given.

The open time of the mastic adhesives with various clay type grades has been displayed in *Figure 6*.

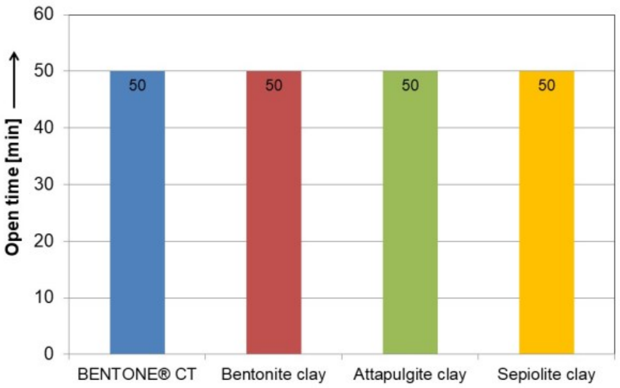


Figure 6: Open time

It becomes obvious that the open time is equally long with all tested clay chemistries.

Conclusion

The use of BENTONE® CT is highly efficient and provides in the best sag resistance of all tested samples. It gives optimum workability and outperformed the samples formulated with attapulgite, sepiolite and bentonite clay. Further, BENTONE® CT, gives excellent storage stability and the highest yield point.

Appendix

Test formulation

Compound	Concentration [%]
Water	13.6 - X
NUOSPERSE® FX 504	0.2
Defoamer	0.2
Biocide	0.1
Coalescing agent	1.2
Calcium carbonate fillers (various particle sizes)	57.0
Styrene/acrylic copolymer based binder emulsion	25.9
HEC	0.6
Hectorite based rheology modifier	X
RHEOLATE® 125	1.0
Neutralizer	0.2
Total	100.0

Test methods:

Rheology data

Viscosity was measured with the Physica MCR 300 rheometer, measuring system CC 27, at a constant shear rate of 5 s^{-1} 24 hours after manufacturing and after 2 weeks storage time at 50°C to determine viscosity stability.

Yield point

Yield value was measured with Physica MCR 300, measuring geometry PP 25 (plate/plate, serrated surface, 1.5 mm gap distance), at a temperature of 23°C. Shear stress was increased over approximately 2 minutes from 0 Pa up to 1000 Pa. Calculation of the yield point was performed using the tangent crossover method. The first tangent was set in the curve interval of the elastic deformation range with the low shear stress. The second tangent was in the measuring curve at high shear stress. When the sample flows, this tangent showed higher slope increase than the first tangent. The yield point was taken at the tangent crossover point.

Open time

Using a serrated trowel (6 x 6 mm), the tile adhesive was applied on the smooth side of a footway slab of exposed aggregate concrete. After 3 minutes an earthenware tile of 5 cm x 5 cm was placed with its rough side on the adhesive and weighted down with 1 kg for 30 seconds. Additionally, tiles of equal size were placed into the adhesive after 6, 9, 12, 15, 18 and 21 minutes and also weighted down with 1 kg for 30 seconds. All tiles were turned upside down after further 10 minutes to assess wetting on the back of each tile with adhesive. For all time periods the adhesive stuck to the back was assessed. The open time recorded was the time interval when > 50% of the adhesive stuck to the back.

Workability

Workability was evaluated by applying the adhesive with a serrated trowel on vertical concrete slabs. The stickiness on the tool and the force required during application were determined.

Sag stability (modified EN 1308)

The test method has been based on EN 1308. Using a serrated trowel (6 x 6 mm), the tile adhesive was applied on the smooth side of a paving slab, made from exposed aggregate concrete. After 5 minutes, 3 earthenware tiles 10 x 10 cm glued on top of each other (340 g) were placed with their rough side into the adhesive and weighted down with 5 kg for 30 seconds. The concrete slab was than positioned vertically and stored for 20 minutes. After this time period sag of tiles was determined.

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