



**■ - BASF**

We create chemistry

## **BASF Solutions for Gypsum Wallboards Applications**

Selection guide of a wide range of innovative  
***Foaming Agents*** and ***Superplasticizers***  
to optimize your gypsum wallboard designs and needs

# BASF – Your Partner of Choice in Gypsum Wallboards



Gypsum wallboards are part of the prefabricated products.

The production of gypsum wallboards is a very long period optimized process and so complex that even a small change in chemical additives used in the system or adjustment of any production parameter can destabilize the whole optimized process and can create troubles. Testing and evaluating new products directly on the line is in most cases of high risk and expensive.





## **BASF APPLICATION TECHNOLOGY**

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BASF has established advanced application technology and mineralogy for a better understanding of the gypsum wallboard process. Our target is to simulate under lab-conditions the whole production process. The lab screening results

must be reliable and transferrable to the plant conditions. A careful balance is considered to achieve both physical performance parameters as well as economic processing conditions, to get the highest performance from these chemical additives.

## **BENEFITS FOR YOU AS A CUSTOMER**

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BASF prescreens foaming agent and superplasticizer recommendations to help you reduce testing time and effort. It also increases the plant trial success probability to reduce development costs.

Our service shall ensure that final BASF global gypsum wallboard solution will exactly meet your demands and fit to your local raw materials i.e. stucco and the conditions in your wallboard production line.

# Vinapor® GYP

## Air pore design for gypsum wallboards

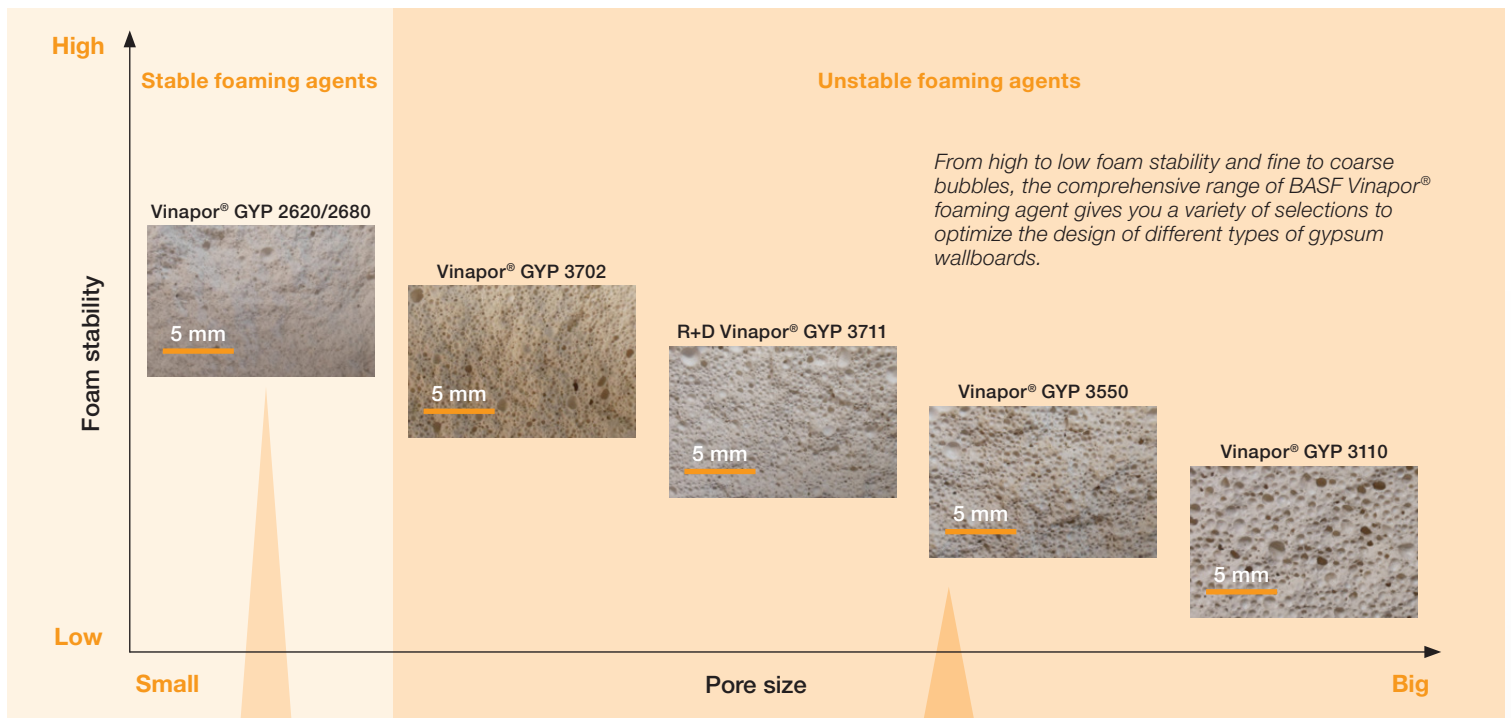
BASF offers a complete range of foaming agents, which allows continuous adjustments of the air pore size and distribution in gypsum wallboards. Depending on the target size and density of the final wallboard and on the interactions of foam with locally available stucco and other additives (e.g. superplasticizer, hydrophobizing aid), BASF can offer the right surfactant solution for it.

## Role of foaming agent in wallboard production

- Improvement of process stability
- Reduction of board density
- Optimization of air pore structure for higher core strength values

## Product range

Vinapor GYP is the brand name for a series of specially designed foaming agents derived from stable foaming agents and unstable foaming agents.



**Stable foaming agents**, i.e. Vinapor GYP 2620 and Vinapor GYP 2680 are applied to generate fine bubble. They can be used for robust production processing and compatible with different production situation with high foam efficiency.

**Unstable foaming agents** are designed to generate different bubble sizes. They are compatible with various raw materials and advanced production technologies to achieve optimized structure. In general, low wallboard density without strength loss is one of the key requirements from customers. The optimized structure has positive impact on density reduction, which helps customers to save raw material cost and achieve high product quality.

Among unstable foaming agents, Vinapor® GYP 3110 and Vinapor® GYP 3550 generate coarse bubbles to develop lightweight gypsum wallboards.

Vinapor® GYP 3702 and Vinapor® GYP 3711 generate mid to coarse bubbles with high foam efficiency.

BASF offers a wide range of products for customers to choose the most suitable foaming agents based on their desirable wallboard density and dosage.



*Different bubble structures of gypsum wallboards*

## Features

## Benefits

Broad range of foaming agents from very stable to very unstable foam character	<ul style="list-style-type: none"><li>■ Robust processing</li><li>■ Suitable for various kind of stucco qualities</li><li>■ Compatible with all kind of chemical additives esp. hydrophobizing aids (silicon oils)</li><li>■ Excellent solubility</li></ul>
Pore design	<ul style="list-style-type: none"><li>■ Adjustment of target pore structure</li><li>■ Optimized paper bond</li><li>■ Improved core strength values or density reduction</li></ul>
Different solid contents available	<ul style="list-style-type: none"><li>■ Suitable for all kind of production equipment</li><li>■ Optimized logistics and handling</li></ul>

## Foaming Agents Portfolios

Product	Chemistry	Active content	Character
R+D Vinapor® GYP 3711	Anionic based surfactant mixture	35-37%	Unstable foam for very coarse air pore design with high foam efficiency
R+D Vinapor® GYP 3702	Anionic based surfactant mixture	32-34%	Unstable foam for medium air pore design with high foam efficiency
Vinapor® GYP 3110	Anionic based surfactant mixture	34-36%	Highly unstable foam for very coarse air pore design, e.g., light-weight boards
Vinapor® GYP 3550	Anionic based surfactant mixture	34-36%	Unstable foam for coarse air pore design, e.g., light-weight boards
Vinapor® GYP 2620	Anionic based surfactant mixture	26.5-27.5%	Stable foam for small air pores and robust processing
Vinapor® GYP 2630	Anionic based surfactant mixture	26-28%	Stable foam for small air pores and robust processing
Vinapor® GYP 2680	Anionic based surfactant mixture	26-28%	Stable foam for small air pores and robust processing
Vinapor® GYP 10	Anionic based surfactant mixture	55-57%	Stable foam for small air pores and robust processing. Increased solid content

## Melflux®

### High-performance superplasticizers for gypsum wallboard production

Melflux® superplasticizers have a comb-like structure containing polyethylene glycol side chains and carboxylic or phosphate groups as charge carrier. Therefore, Melflux® superplasticizers offer additional water reduction potential compared to standard superplasticizers, such as polynaphthalene sulfonates (BNS) or lignosulfonates (LS).

#### Role of superplasticizers in wallboard production

- Provides sufficient fluidity of water-stucco-mix
- Reduces water demand of stucco to reduce energy costs for evaporation of excess water



#### Product range

Depending on stucco quality, BASF provides suitable high performance superplasticizers, compatible for all sources of stucco. Melflux® is a range of high performance superplasticizers derived from three major technologies and optimized for different application purposes.

Melflux® PCE

Melflux® Plus

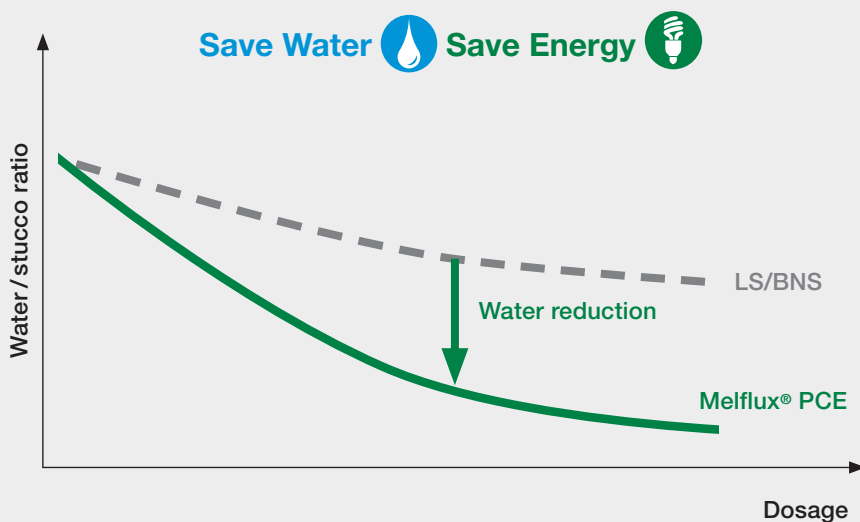
Melflux® CC

### Melflux® PCE

Melflux® PCE grades are based on modified polycarboxylic ether polymers. They are designed for use in high purity calcium sulphate (natural or synthetic) based wallboard products.

Features	Benefits
Very high dosage efficiency	■ Cost effective replacement of commonly used dispersants
Very high water reduction potential	■ Reduced evaporation requirements thereby reduced energy costs ■ Increase of plant productivity, if plant is limited by drier capacity
Controlled influence on foam stability	■ Pore structure of wallboard can be finely adjusted by choice of superplasticizer (N.D. or F.F. type)

Water reduction with synthetic and pure natural stucco



#### Dispersant replacement

- Cost efficient replacement of LS/BNS at maintained water/stucco ratio
- Retardation plays minor role due to very low dispersant dosage

#### Further water reduction

- Save drying costs as a result of significant reduction in water/stucco ratio
- Retardation becomes crucial due to higher dispersant dosage

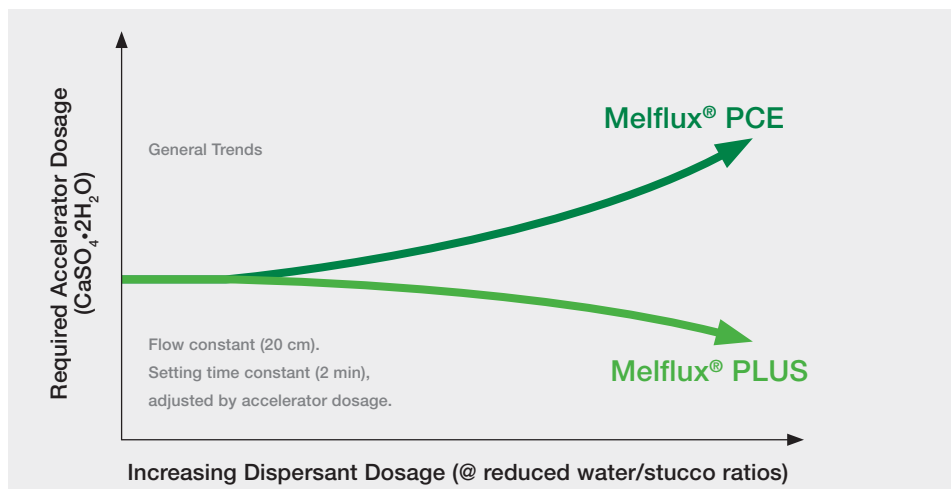
# Melflux® PLUS

Melflux® PLUS is our range of phosphate containing polymeric superplasticizers. This recent technology from BASF enables use in either synthetic or natural stuccos with clay impurities. Even at high dosages Melflux® PLUS has very limited impact on set time of stucco.

Features	Benefits
Outstanding water reduction potential	<ul style="list-style-type: none"> <li>■ Reduction of energy costs because less water needs to be evaporated</li> <li>■ Increased plant productivity; if plant is limited by drier capacity</li> </ul>
Compatibility with clay impurities	<ul style="list-style-type: none"> <li>■ Impressive fluidification of natural stuccos even with significant impurities found in stucco</li> </ul>
No retardation of setting process	<ul style="list-style-type: none"> <li>■ Increased dosage for further water reduction possible without additional accelerator necessary – superior performance to polycarboxylic ether polymers</li> </ul>

## Influence on Setting Process

Melflux® PLUS shows almost no retardation effect on setting time of stucco. It allows for increased dosage for further water reduction while simultaneously reducing accelerator dosage!



## Melflux® CC

Melflux® CC (Clay Compatible) has been optimized for use in natural stuccos with very high clay impurities providing enhanced dispersing performance and dosage efficient water reduction..

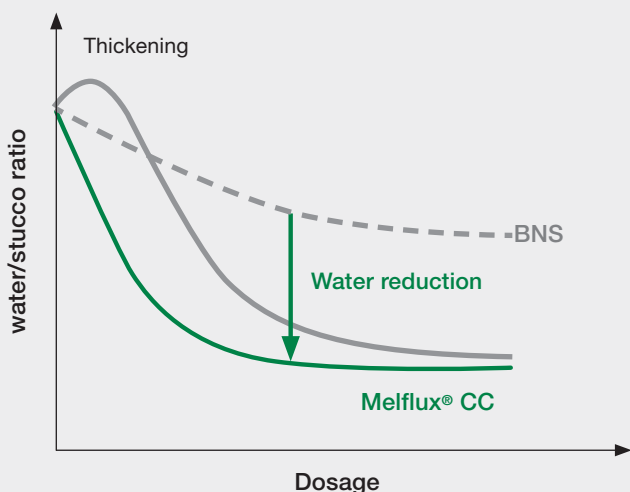
## Dispersant performance in natural stuccos with clay impurities

### Dispersant replacement

- Cost efficient replacement of BNS at maintained water/stucco ratio
- Lower dosage compared to any other dispersant technology
- No thickening of stucco slurry at low dispersant dosages

### Water reduction with natural stucco having high clay content

Save Water Save Cost Save Energy



### Further water reduction

- Save drying cost because of significant reduction of water/stucco ratio
- Higher dosage efficiency of Melflux® CC compared to PCEs

### Robustness to deviating clay contents

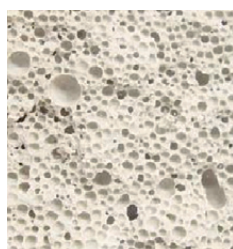
- Increased stability of production process due to superior robustness against variations in clay impurities.



## Melflux® - Adjustment of pore structure

Plasticizers typically show strong interaction on the air pore structure and negatively impact gypsum wallboard performance. Melflux® plasticizers can work in harmony with selected foaming agents and optimize air pore size and uniformity. BASF grades offer additional degrees-of-freedom in achieving desired air pore design.

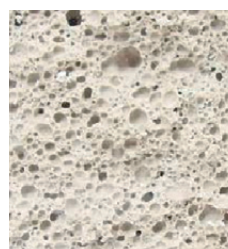
- Melflux® N.D. types tend to stabilize foam and therefore produce wallboards with fine bubble structure.
- Melflux® F.F. types for tolerating coarse bubble structures and working in concert with selected Vinapor® GYP grades for desired results.



BNS



Melflux® PCE N.D.



Melflux® PCE F.F.

## Superplasticizers Portfolios

Product	Chemistry	Active content	Character
Melflux® PCE 26 L/F.F.	Polycarboxylic ether, foam friendly	Approx. 40%	Foam structure optimized, BNS replacement with outstanding dispersing properties
Melflux® PCE 541 L/F.F.	Polycarboxylic ether, foam friendly	Approx. 44%	Foam structure optimized, BNS replacement with outstanding dispersing properties
Melflux® PCE 1493 L	Polycarboxylic ether	Approx. 40%	PCE for BNS replacement, usage in combinations with stable foams
Melflux® PCE 239 L	Polycarboxylic ether	Approx. 35%	Slight water reduction, reduced retardation properties. Usage in combination with stable foams
Melflux® PLUS 1085 L	Phosphate based polymer	Approx. 32%	Phosphate based polymer for high water reduction properties at very low retardation of gypsum set
Melflux® PLUS 312 L	Phosphate based polymer	Approx. 32%	Phosphate based polymer for high water reduction properties at very low retardation of gypsum set



# TESTING METHODOLOGIES FOR FOAMING AGENTS AND SUPERPLASTICIZERS SELECTION

BASF's well-equipped technology labs can support the right selection of foaming agents and superplasticizers to optimize your gypsum wallboard designs and needs via the following testing methodologies –

1. **Unfoamed slump test**
2. **Foaming test for surfactants**
3. **Simulation of the forming table, interactions between stucco, surfactant and dispersant**
4. **Gypsum analytics and mineralogy**

## 1. Unfoamed slump test

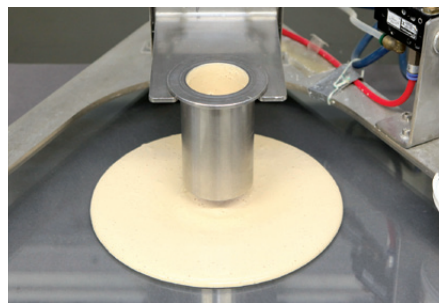
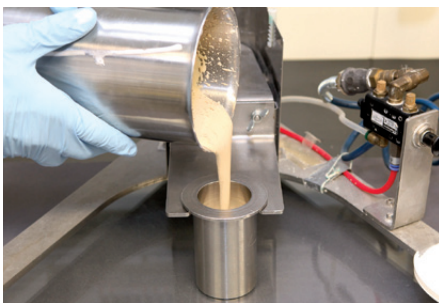
Information like flow and setting time (retardation effect), water reduction potential and dosage efficiency of dispersant can be obtained by screening of different superplasticizers.

### Data obtained from this test

- Information about water demand, setting time and flow behavior of stucco

### Benefits

- Compatibility between stucco and superplasticizer
- Possibilities of water reduction
- Cost performance ratio of superplasticizer technologies (dosage efficiency)
- Optimization of setting behavior for faster production process (retarding effect)



## 2. Foaming test for surfactants

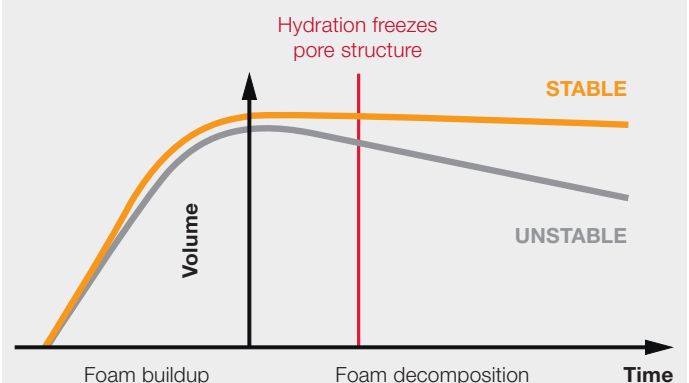
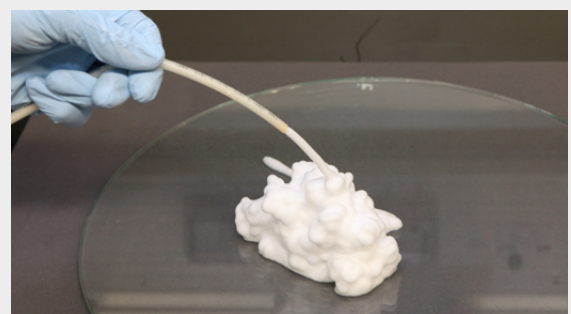
For characterization of different surfactants, we can create and measure parameters which define the foam properties. With this test we get information about density, efficiency, stability, half-life and flash height. All these parameters have influence on achievable pore structure of a gypsum wallboard.

### Data obtained from this test

- Evaluation of foam properties

### Benefits

- Robust processing
- Quality control
- Comparison of different surfactant technologies concerning:
  - Foaming power/capacity
  - Foam stability
  - Pre-selection for air-pore design
- Solubility in different water qualities (pH, temperature, salts, impurities)



### 3. Simulation of the forming table

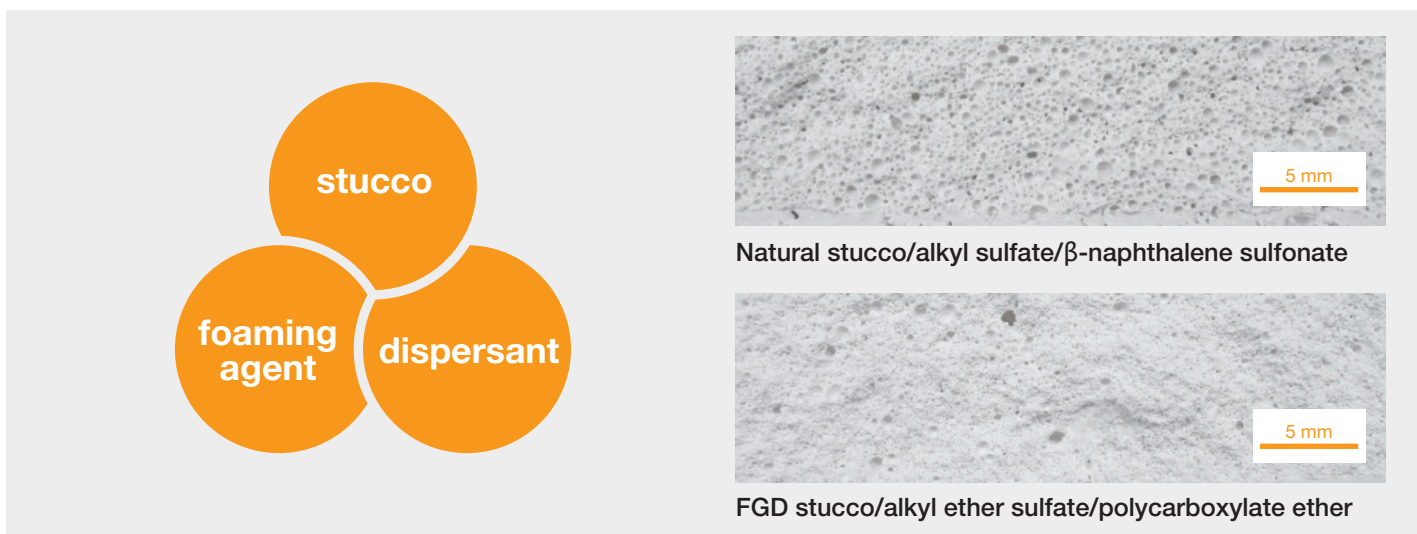
To simulate the forming table, interactions between stucco, dispersant and surfactant have to be investigated in one lab method. Therefore, we combined slump and foaming test and developed our BASF foamed slump test. This test indicates the compatibility of the combined additives with stucco and therefore a substitution of additives at production site could be done with less risk.

#### Data obtained from this test

- Simulation of forming table

#### Benefits

- (In-)compatibilities of used raw materials (stucco, silicon oil, etc.)
- Full picture of used raw material interactions
- Prediction of influence of additives on final air pore structure
- Prediction of potential for density reduction
- Evaluation of robustness of additive package
- Reduced risk for additive changes in board production



### 4. Gypsum analytics and mineralogy

For understanding of interactions and incompatibilities of raw materials in the wallboard process, a variety of analytical methods in BASF mineralogy have been developed to help you choose the right additives. The following standard analytical methods are mainly used:

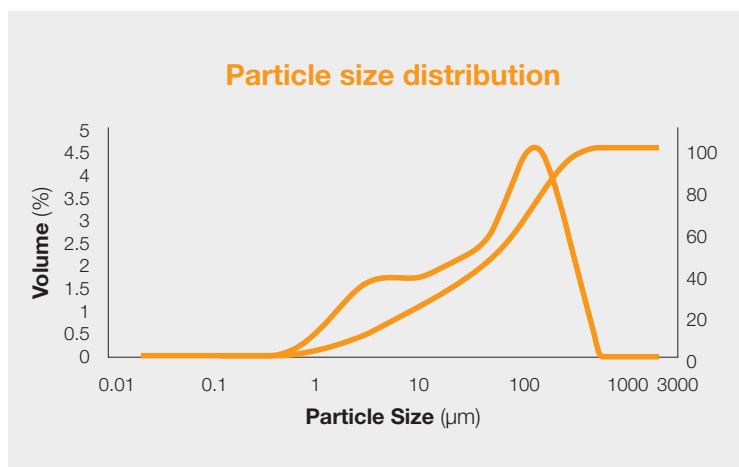
- Phase analytics with Rietveld refinement
- Oxide composition by XRF
- Clay index determination (BASF method)
- Particle size distribution
- Heat flow calorimetry

#### Data obtained from this test

- Gypsum analytics

#### Benefits

- Characterization of stucco concerning composition, purity and reactivity
- Information on calcination process (overburning, residual dehydrate, aging)
- Detailed list of contained impurities
- Preselection of different additives concerning compatibility with your stucco





# BASF – YOUR PARTNER OF CHOICE IN SUSTAINABLE CONSTRUCTION SOLUTIONS

At BASF, we create chemistry that helps the construction industry meet specific needs for ecologically friendly sustainable solutions with outstanding functionality and performance in different aspects.

## We create chemistry for a sustainable future

BASF wants to contribute to a world that provides viable future with enhanced quality of life for everyone. We do so by creating chemistry for our customers and society and by making the best use of available resources. We live our corporate purpose “We create chemistry for a sustainable future” by



## Driving sustainability for long-term success



