



Sample preparation in the Ceramics Sector

Essential for quality and process standards assurance

Clays, chamottes and ceramics are used in various ways and must therefore be in accordance with different degrees of quality standards. These quality standards have especially in recent years gained in significance for the processing industry and therefore at the same time for the producers of such chamottes and ceramics.

Based on the risen quality standards more and more often, the crude materials and also the finished products are more precisely analysed. Considered are the classic chemical and physical variables, as well as the technological data of crude materials and finished parts like for example

- Geochemical and mineralogical composition
- Thermal shock resistance
- Thermal conductivity & coefficient of thermal expansion
- Breaking resistance & flexural strength

Based on the very inhomogeneous composition of clays, which are mostly composed of various clay minerals, a sample preparation in a clay and ceramics laboratory for further analytical use via x-ray fluorescence, atomic absorption spectrometer, or inductively coupled plasma emission spectrometry, or AES is mandatory, since the chemical composition of the crude materials has a decisive influence on the technical abilities of the finished products.

Due to these facts, one of the leading producers for crude clays, milling clays, chamottes and ceramic masses, the renowned company from the Westerwald region in Germany, Goerg & Schneider, chose the FRITSCH **Planetary Mono Mill PULVERISETTE 6 classic line** with an agate grinding set, for the efficient and time saving sample preparation.

The main area of utilization of the PULVERISETTE 6 *classic line* is the fine grinding of milling clays respectively pre-broken pieces of firing clays. The size of the basic sample is between 0.2- 5 mm.

The finely ground chamottes are needed in order to produce - by adding bentonite as a bonding clay - models for the determination of the thermal expansion coefficient. Furthermore, the in this manner obtained sample amount of approximately 100 grams is used for the disintegration of the fusion tablet during the X-ray fluorescence analysis in order to determine the chemical composition of the finished product.

The decision in regards of the selection of the comminution tools is mainly based on the chemical composition (see element analysis below), as well as in the physical and mechanical characteristics of agate.



Element Analysis

Element	Share
Silicone oxide – SiO ₂	99.9 %
Aluminium – Al ₂ O ₃	< 0.02 %
Iron oxide – Fe ₂ O ₃	< 0.02 %
Calcium oxide – CaO	< 0.02 %
Magnesium – MgO	< 0,02 %
Sodium carbonate – Na ₂ O	< 0.02 %
Potassium carbonate – K ₂ O	< 0.02 %
Manganese oxide – MnO	< 0.02 %

Physical and mechanical properties

Density	2.65 g/cm ³
Hardness	6.5 – 7 Mohs

Due to the considered relative chemical neutrality of the composition (99,9 % SiO₂) therefore no other elements from the agate, respectively from the preparation, influence at all or only in a limited manner the material characteristics, like for example the firing colour, thermal conductivity, or the flexural strength of the finished products. The Mohs hardness of the agate with 6.5 -7, is above this also sufficient for fulfilling the demanded tasks in a qualitative manner of a 100 %.

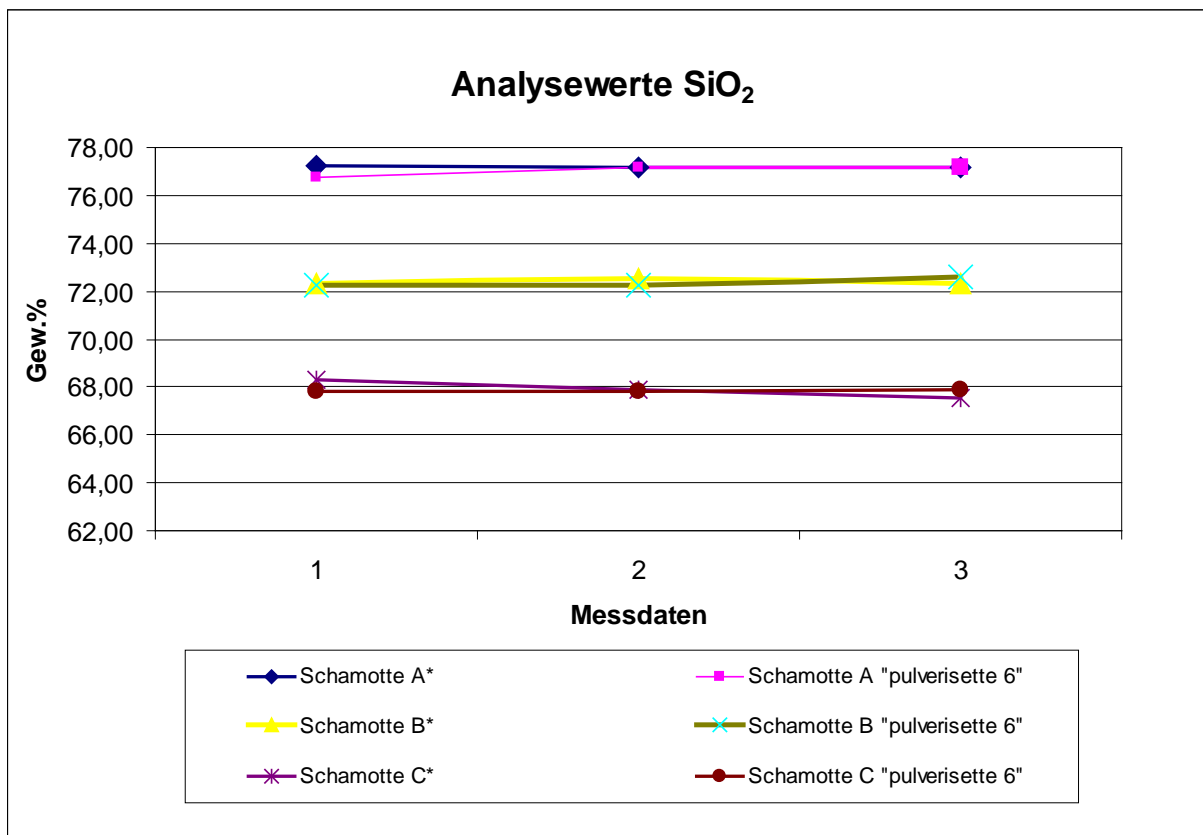


Illustration A: Comparison of the **weight** % of SiO₂ of various fireclays from past preparation methods (firing clays A*-C*) prepared with the FRITSCH Planetary Mono Mill PULVERISETTE 6 classic line.



Illustration A shows that the insertion of SiO_2 as indicator for the emerging abrasion during mechanical comminution of the agate grinding set, can despite the clearly higher application of energy of the Planetary Mill compared to the previous preparation with the mortar principle, be almost completely ignored.

An additional, very decisive criterion for the purchase of the Planetary Mono Mill PULVERISETTE 6 *classic line* by FRITSCH, was the efficient preparation and the associated time saving during the sample preparation with this type mill – the Planetary Mill.

Due to the use of the Planetary Mill, 90% of time was saved, compared to the previously used mechanical preparation.

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