SAMPLING, IMPORTANT CONDITION AND FOUNDATION FOR ACTUAL QUALITY CONTROL

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1. INTRODUCTION

Correct sampling of ceramic raw materials and products is very important for quality assurance. Sampling is not only performed on received raw materials, but also in the process chain during processing and on the end product. If carried out properly, sampling is indispensable for reliable quality assessment regarding the functionality, appearance and composition of a specific product such as a ceramic tile.

2. SITUATION

For finished products some sampling standards exist on the European level, for raw materials and semi-manufactures there are however only few on a national level. Here action is needed. Sampling always takes place at the beginning of each test. It is decisive whether the test results obtained are useable and authoritative or not. The high accuracy of modern analytical methods can be rendered useless by serious mistakes in the sampling and sample preparation. Furthermore only in extremely rare cases a test can be carried out on a complete batch as the basic entity, in most cases one has to resort to random samples to be taken. The sampling procedure should be designed in accordance with the specific process and the nature of the product. When taking a random sample, it should statistically viable represent the properties of the basic entity, by providing viable values. However, no method of sampling or of sample preparation is free from accidental defects or deviations. It is moreover impossible to completely control the variables affecting the results. For this reason the result which can be determined is always ultimately an estimated value. The ranges of variations of this value should be known however. It is only in this way that the data obtained can be correctly handled, and put into effect for product and process control.

3. GENERAL SAMPLING

Due to the large variety of possible specimens to be sampled and the requirements for assessment there is also a large number of sampling procedure types which include the following methods:

- Systematic sampling
- Simple random samples
- Periodic sampling
- Specifically directed
- Multistage and
- Random sampling

Combinations of the individual methods are also possible and applied in specific fields. The aim of the sampling should be clearly defined: Is the product to be sampled to be statistically recorded or is a deliberate search to be made for defects, pollutants or special properties?

This defined aim has a decisive influence on the following aspects for the design of the method:

- The sampling plan
- The sample specimen
- The type of sampling
- The sampling equipment
- The person appointed to perform the sampling

In addition to these points a short account of the working procedure is also a useful component of the description of the method. It should include information on responsibilities, measures regarding clearance and restriction on the material. It should also include training and evaluation of the performance of the quality department responsible for testing.

4. SAMPLING FOR CERAMIC PRODUCTION

Special instructions from the field of ceramics, which operate with sampling are stipulated for example in ISO, EN, DIN, ASTM, …. There are also generally used applicable standards, such as ISO 2859 or ISO 3951. Both relate to the sampling and random sample plans for qualitative or quantitative features. No further standards especially for ceramic raw-materials and semi-products are available.

RAW MATERIAL GROUP	COMPOSITION	STATE
Clays, kaolins	Mixture of clay minerals with rock residues (Quarz, feldespars, etc)	Plastic bodies, lumpy, clay powders, suspensions
Feldespars and other rockminerals / sands	Pure minerals with sligth impurities	Lumpy to powder-fine
Chamotte	Fired clays, kaolins and mixtures	Lumpy to powder-fine
Auxiliary materials	Organic / inorganic compounds	Granulates, solutions, pastes

Table 1. Types of raw-material.

The decision for the type of sampling is primarily influenced by the state of the material to be sampled. From this there are many possibilities for subdivision. This can be carried out with reference to the state of the aggregate: in solid, liquid or gaseous form. It can also be made according to the type of delivery: by rail, tipping lorry, big-bag, silo lorry or barrels. Which type of subdivision is used should be specified with reference to the raw-materials occurring in the company itself. The decisive factor is that instructions are prescribed for all giving the procedure to be followed. Very often in ceramic production a subdivision of raw-materials is made according to the type of delivery and the resulting storage.

- Storage in a heap or stockpile
- Storage in boxes

- Big-Bag
- Contained in sacks or bags
- Silo
- Tank

The implementation of sampling instructions on the basis of this subdivision has been proved successful in widespread areas of ceramic production and is a component of various quality management systems.

MAXIMUM GRAIN SIZE IN mm		WEIGTH OF THE INDIVIDUAL SPECIMEN
Over	**Up to**	
100		30 kg
50	100	15 kg
20	50	5 kg
10	20	2 kg
3	10	500 g
1	3	200 g
	1	50 g

Table 2. Necessary Weigth of the individual specimen as a function of maximum grain size.

Sampling is often a laborious and in some cases also an expensive part of the reception of raw materials or the process (semi-finished goods) and end-product. It starts with correct documentation of the data required and the choice of suitable means and instructions. Standards, legal regulations and directives for sampling are available to a very limited extent. For many applications in which specimens are taken and used, suitable instructions can be prepared with simple methods and auxiliaries, in order to enable representative sampling. Only then are the measured values of the expensively performed tests of use, and also reproducible and authoritative. In case of complaints, it is important that the procedure adopted for the sampling should have been specified in instructions. These should be part of the test plan and quality assurance agreement, established by contract between customer and supplier.

5. CONCLUSION

Good sampling is an indispensable basis for a fully functioning and reliable quality control within the production and protection against unpleasant surprises. A thoroughly planned and correctly implemented sampling procedure is further one of the most important foundations for an effective quality management system. Furthermore it is a requirement for any quality agreements between suppliers and consumers. In the case of customer complaints or quality negotiations a documented and correctly accomplished sampling procedure can be the basis for any legal argument.

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