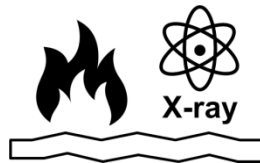


Description



Filler measurement / ash measurement MRP ASH X-ray 2008

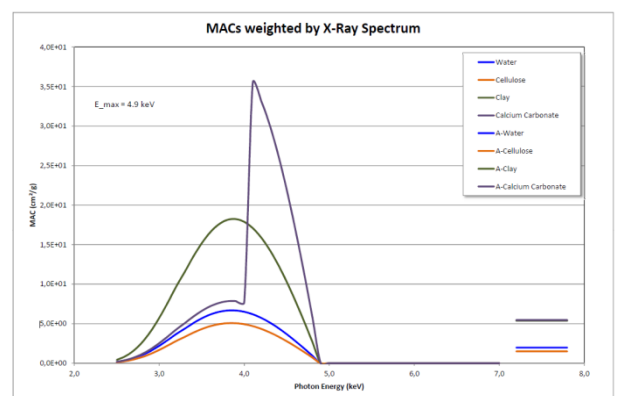
Ash measurement using a X-ray tube and the gamma-absorption principle

The ash content of a paper is defined as the proportion of contaminations, fillers and pigments that are contained in the paper as inorganic substances in addition to the organic components (fibres). These do not burn. Hence the term "ash content". Fillers are additives for paper production. They fill the gaps between the paper fibres, improve the opacity (make the paper more opaque), the printability and also the smoothness of the paper are influenced by them. They also improve the uniformity of the formation. The fillers are usually washed in water and added to the pulp in the mixing vat. Fillers are usually minerals, such as kaolin, titanium dioxide and/or calcium carbonate.

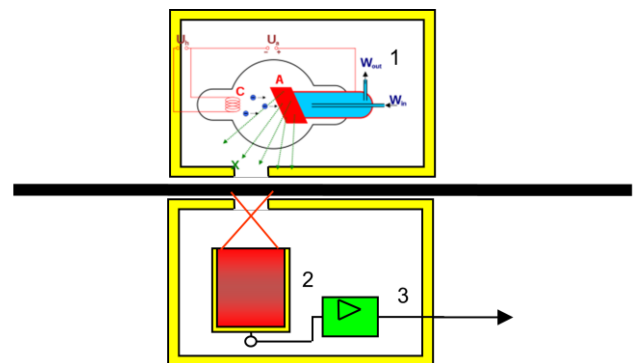
Besides the advantages, disadvantages are also to be expected. Filler particles get stuck between the paper drums and thus reduce the number of fibre-fibre bonds. This results in lower paper stiffness and paper strength.

The filler is determined with a continuous, non-contact radiometric measurement. As radiation source a X-ray tube with an adjustable X-ray voltage ($< 15\text{keV}$) is used. The absorption of the gamma radiation by the paper web is mainly based on the photoelectric effect. The absorption is dependent on the mass absorption coefficient (MAC), and thus a material-dependent variable.

The X-ray voltage in conjunction with suitable filters in the X-ray beam is now adjusted so that the MAC for the fillers is constant. This means that the distribution of the individual fillers does not have to be known in order to determine the total filler, as they all have approximately the same MAC.



If several combinations of fillers are operated in one system, the X-ray voltage must be adjusted according to the recipe. In addition, the corresponding filters are placed in the X-ray channel to create the condition of the same MAC's.



- 1 X-ray tube with various adjustable filters
- 2 Ionization chamber
- 3 Evaluation unit with Profibus connection

Electrical principle

On one side of the product line the X-ray tube, which serves as a radiation source, is placed below.

The radiation is only emitted towards the material to be measured. On the opposite side there is a radiation detector (usually an ionization chamber, but today also semiconductor detectors) which generates a current depending on the received radiation quantity. The currents resulting from this current are in the range of pico amperes (pA, 10^{-12} amperes) for ionization chambers.

Such small currents can only be detected with special amplifiers and are therefore a measure of the mass of the area between the emitter and the detector. Provided that the total basis weight and moisture are known, the filler content can be calculated for the same MAC of the fillers.

The measurement is continuous, non-destructive and has no damaging effect on the product. Special procedures and additional detectors for the compensation of disturbing effects (web flutter, temperature influences) help the x-ray filler measurement to become a highly precise measuring device.

Messgenauigkeiten

Typ	MRP ASH x-ray Füllstoff
Basis weight range	0-400 g/m ²
Resolution	0,01 %
Accuracy - 2-sigma at 1 sec	±0,2 %
Measuring gap	20 mm
Measuring spot diameter	20 mm
Operating temperature	10°C-70°C / 110°C

Alternatively, filler measuring instruments based on a natural nuclide - Fe55 - can be used. We would be pleased to explain the differences and the advantages and disadvantages of the different techniques.