

Test Measurement

Moisture Measurement in PVC Powder

Measuring Task

Application measurement in PVC Powder was carried out in the TEWS laboratory. The objective was to determine a suitable sensor for this product and to confirm that the microwave resonance technology is basically suitable. The samples received from PROTECH Scientific Co. were labelled "PVC F:8.1", "PVC F:8.2" and "PVC F:8.3" and contained smaller sample bags characterized by moisture contents of 0,17 to 0,56% - though the provider was not entirely sure about especially these two frame values. These two samples were stored for a longer period than all other samples. The customer notes that one bag marked "FE" contains also traces of iron and has to be considered carefully for moisture inspection.

Following images originate from original measurements.

Product:	PVC Powder varieties incl. trace material
Moisture range:	0,17-0,56 % (as obtained)
Sensor:	SLH46, SLE20
Resonance:	Hi Mode

Test Measurement

Samples

Sample	Symbol	Reference Moisture	Handling
1	+++	0,17	None
2	###	0,56	None
3	***	Unknown (cont. FE traces)	None
4	ooo	0,20	None
5	Ooo	0,27	None
6	---	0,36	None
7	lll	0,31	None
8	~~~	0,44	None

Reference moisture measurements were carried out in samples labelled 0,17% and 0,56% as the client was uncertain whether the original moisture content was still the same due to the long storing period. The measurements were conducted with a Mettler Toledo Halogen quick test at 150°C and resulted in 0,11% for the sample labelled “0,17%”, and 0,17% for the sample labelled “0,56%”.

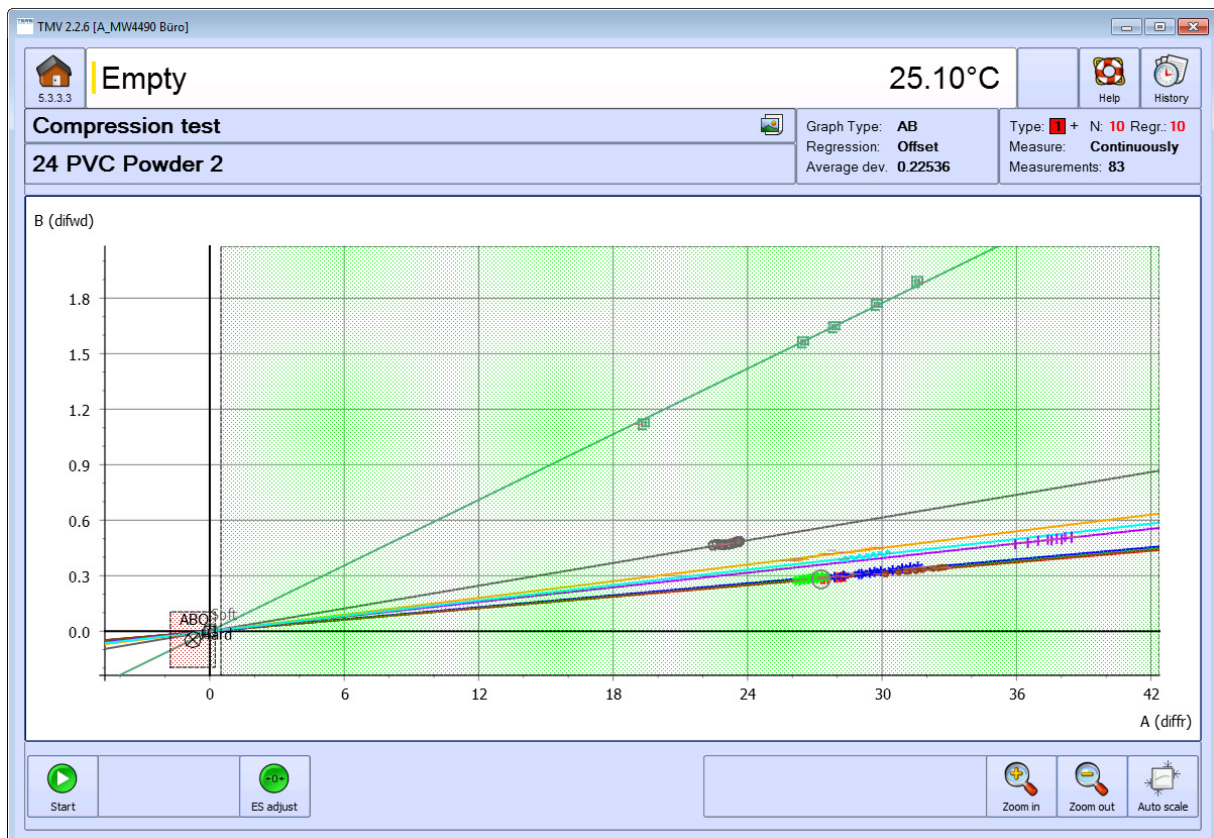
Thus it turned out that the reference moisture values could not be trusted anymore.

In order to get reliable samples with different moisture contents TEWS laboratory staff created those by moistening up three samples.

Compression Test

Compression test was carried out with all five samples at three different moisture contents. The following image shows the results of the compression test with the x-axis representing the A-value and y-axis showing the B-value.

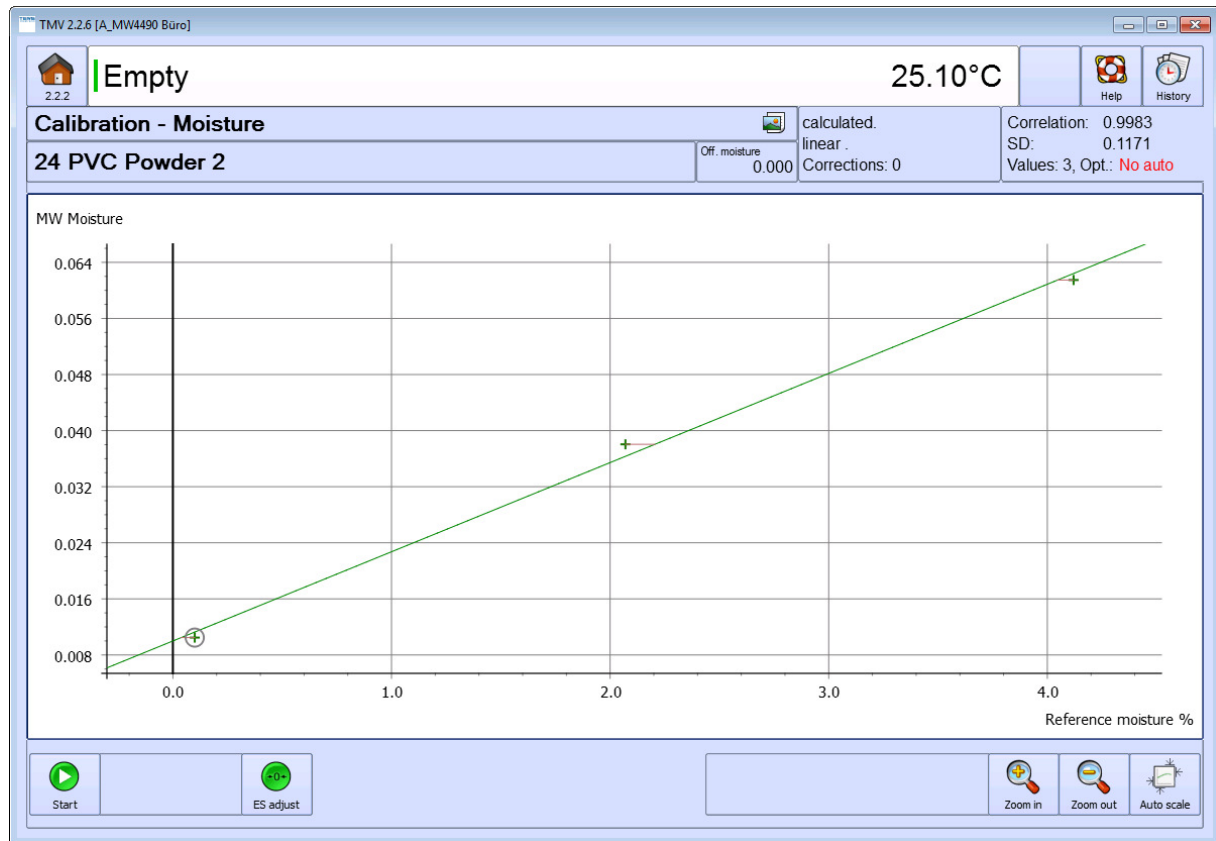
SLE-20 B:



Calibration

The calibration curve demonstrates the relationship between the microwave measurement values initially taken by the device and the subsequently displayed moisture values.

SLE20 B:



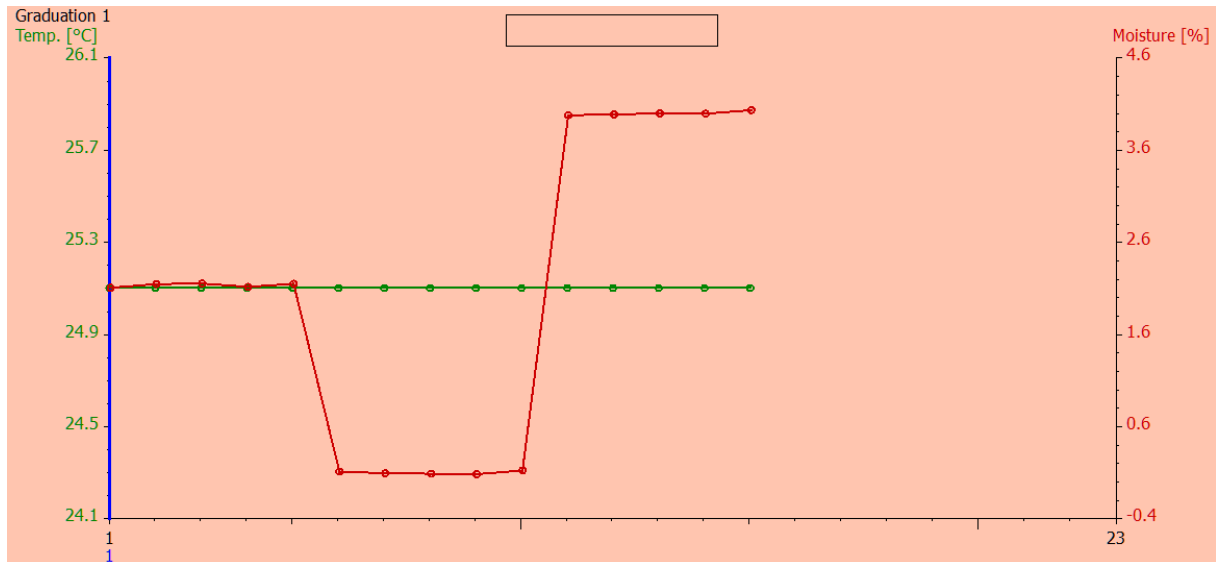
Number of samples: 3

Correlation: 0.9983

Average deviation: 0.1171

Reproducibility measurement

This measurement demonstrates how accurate the measuring device can repeat the results of the samples. The statistics mean value and standard deviation are hereby evaluated. Also it clarifies the independence of moisture and density.



Measurement of sample 1 (reference: 2.07%), sample 2 (ref.: 0.1%), sample 3 (ref.: 4.1%)

Measurement conducted 5 times per sample

Mean value: sample 1: 2.13% / sample 2: 0.097% / sample 3: 3.99%

Standard deviation: sample 1 0.021% / sample 2: 0.017% / sample 3: 0.021%

Conclusion

Microwave resonance technology is well suited to determine the moisture content in PVC powder in the range from 0.1 to 5.0%. If the moisture is higher than around 5.0% the products tends to stick.

Reproducibility tests showed a standard deviation of 0.02%.

Measuring method

The TEWS moisture measurement device is essentially based on the microwave resonance method. A stationary microwave field is generated in the cylindrical sample chamber over the planar sensor. A resonance peak is built up whose frequency and line width are measured. These parameters change, if a product containing water is brought into the microwave field. A density-independent and moisture-correlated measurement signal is obtained. The absolute moisture level can then be achieved by calibration against one of the normal direct methods, such as drying oven or Karl-Fischer-titration.

The measurement is carried out in the laboratory by filling the product directly into the cylindrical sensor. For in-line control, measurement is automated by leading the product over the sensor with contact. The measurement is carried out during the movement.

The measured value is available in less than one second and is saved automatically. The system registers up to 50 individual values per second. After appropriate averaging, these values can either be used to control the production process or to be saved and made available to quality control.

For High-quality Industrial Application

Characteristics of the Microwave Resonance Method

