

S12 - Multi-Imaging (3D) – Welding Powder

Measurement System: PartAn 3001L



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The requirement for quality standards is increasing steadily. In addition to other quality characteristics, such as **particle size distribution**, information on the **particle shape** (length/thickness; flakiness, etc.) is becoming more important when assessing material quality. Current conventional methods of analysis, such as sieving, are time consuming and provide insufficient detailed information.

In cooperation with our customers, AnaTec has advanced the further development of their PartAn System (Particle Analyser) with multi imaging technology. With the new **Multi-Image-System** it is now possible to acquire **much more precise** data on:

Particle size distribution, length-thickness calculation, the flakiness and sphericity of the particles.

With this Multi-Image method a full sample analysis is completed in less than 5 minutes. The raw data evaluation of the Multi-Image method shows excellent correlation to the more traditional, manually performed analysis methods.

This application covers especially the product welding powder.

The manufactures of welding powders are bound to specific quality requirements. A very important quality requirement is the information on the particle size distribution and the particle shape of the product. Therefore a frequent – if not continuous – particle analysis is essential to fulfil the specifications.

The PartAn particle analyser allows very accurate measurement of welding powders with a high repeatability and – compared to traditional sieve analysis – within a very short time.

INTRODUCTION

The PartAn - Particle Size Analyser is an instrument for measuring the size distribution and shape of particles. This version has been built for laboratory use. Samples have to be taken manually from a flow of particles of the desired product and transferred into the instrument feed hopper. The vibration unit ensures a constant particle flow into the measurement area (camera – light source).

The particle analyser uses computer vision technology. An image is captured, stored in the computer where measurement analysis is completed.

Based on this EPS application it implies:

- **Measuring particle size**
- **Measuring particle sphericity**
- **Counting particles**

THE MEASUREMENT / FUNCTION

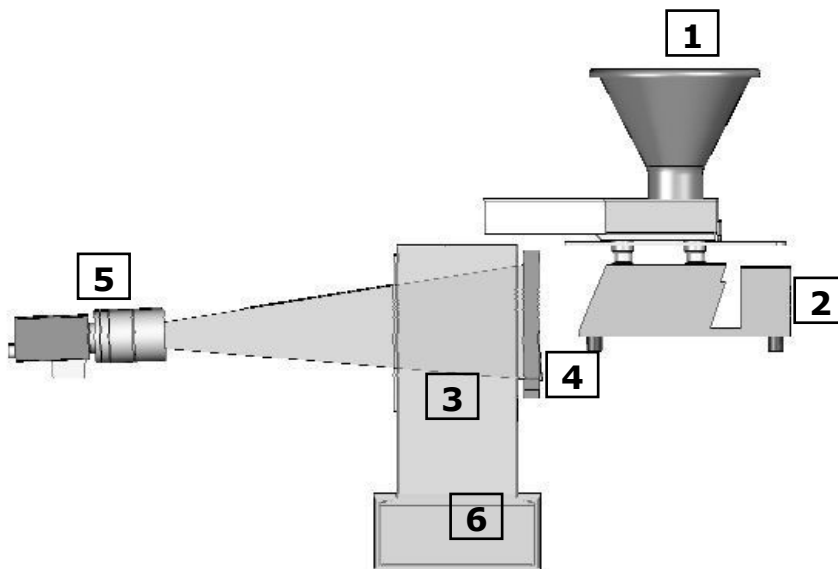


fig.: Sketch/internal structure

The sample material is placed into the hopper (1). The vibrator unit (2) creates a continuous single-layered flow of particles. The particles pass through the measurement area (3) between light source (4) and camera (5). Here the measurement takes place and finally the particles fall into the sample collection box (6).

When the light source emits a flash, the camera records images of the free falling particles and transfers the images to the computer. The images are analysed and calculations are carried out by the PartAn software. The measurement results and particle images are presented on the PC-monitor in real time.

Light source and sample feeder (vibrator) are controlled automatically by the PartAn Software. The vibrator control is based on the area covered by particles in the image.

Multi-Image Analysis

The PartAn 3001L is able to analyse the sample by multi-image mode with several hundreds images per second.

As every single particle is imaged several times and **captured from different angles**, the software is able to calculate very precisely the particle shape and gives much more precise information of the particle size distribution.

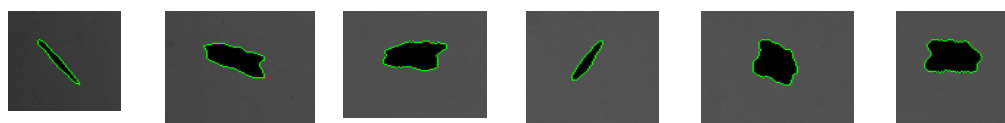
The image-sequence below is from the very **same particle**, which was **captured five times** while passing through the measurement area. During the fall it is natural that particles are tumbling. You can clearly see that the particle's shape and size is differing by each of the captured images. Based on this particle information data, the software is able to calculate a much more precise size and shape.

L/T is showing the length-thickness ratio of each particle.

	Image no.65	Image no.66	Image no.67	Image no.68	Image no.69	Image no.70
sample 1						
Thickness	20.384	23.546	26.54	20.639	25.165	26.649
Area	29.638	32.559	28.819	25.211	32.774	33.175
L/T	2.22	2.233	1.391	1.534	1.97	1.896



	Image no.206	Image no.207	Image no.208	Image no.209	Image no.210	Image no.211
sample 2						
Thickness	4.616	18.477	23.375	6.97	28.619	26.259
area	13.061	28.747	30.029	15.252	30.492	35.213
L/T	9.76	2.575	1.931	5.394	1.426	1.787



The standard method of digital-image-processing systems captures the particles **once** and calculations will be made on this single set of particle information.

These results can differ, depending on which angle the particle image is captured: square-shaped particle (image no. 211); more needle-shaped particle (image no. 206)

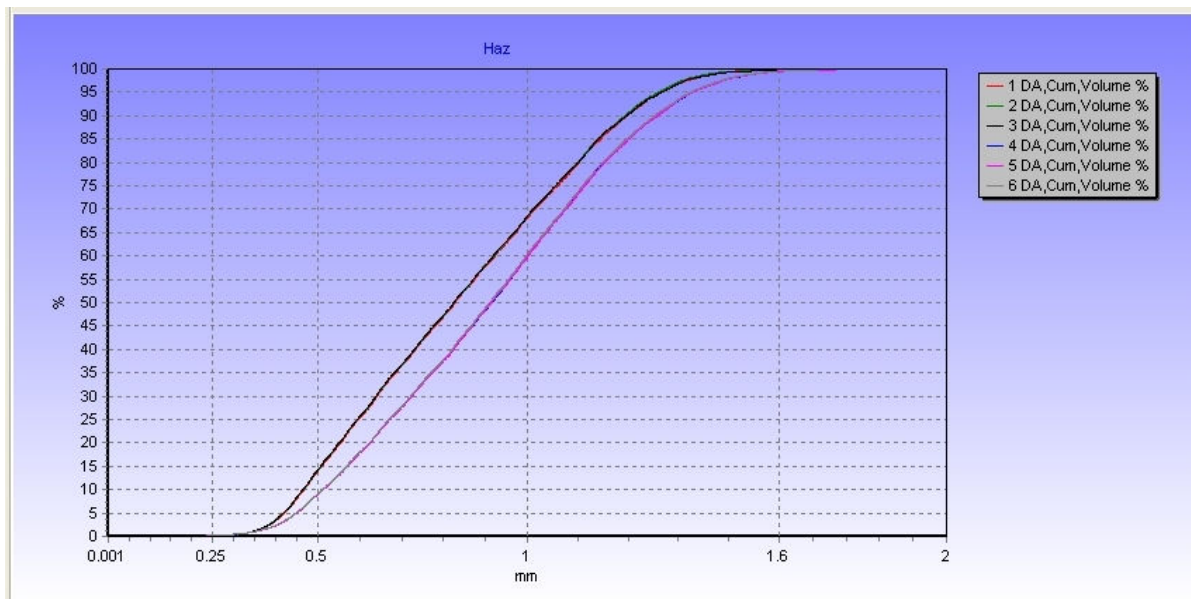
All other values / results are calculated from these basic values.

RESULTS

The analysis was done in the multi-imaging mode with several hundreds of images per second. Each single particle was captured and analysed 5 times. The analysis was done by the thickness of each particle – results based on this calculation showing a good comparison to the standard sieve analysis.

The table below is showing the measurement results of the samples.

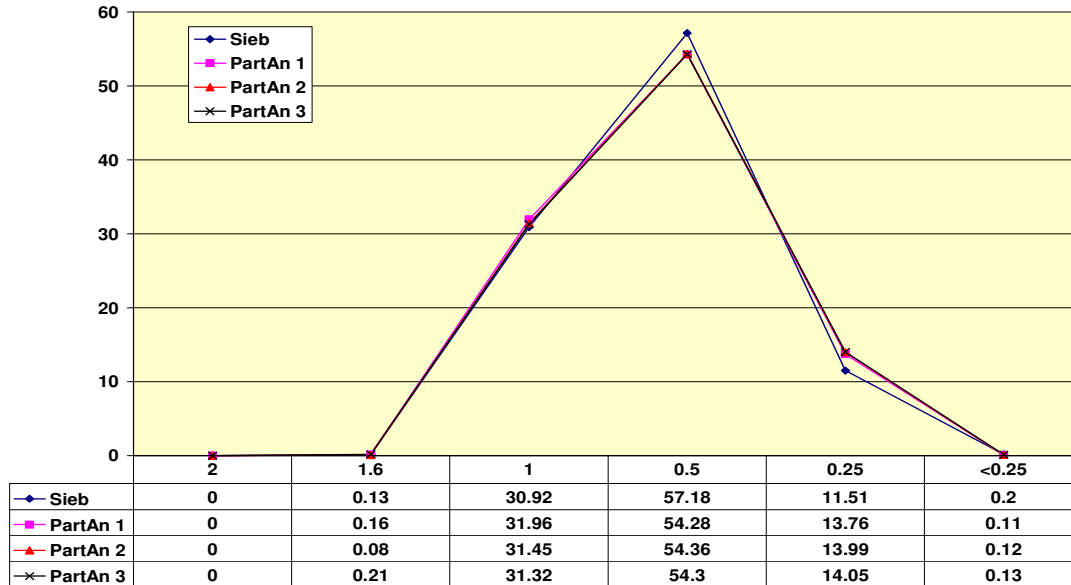
Particle size distribution of the different samples in comparison



XY-Table

	Distribution	Flakiness	Shape			
Haz	1 DA,Cum	2 DA,Cum	3 DA,Cum	4 DA,Cum	5 DA,Cum	6 DA,Cum
mm	Volume %	Volume %	Volume %	Volume %	Volume %	Volume %
2	100.00	100.00	100.00	100.00	100.00	100.00
1.6	99.84	99.92	99.79	99.51	99.46	99.57
1	68.15	68.47	68.47	59.89	59.69	60.37
0.5	13.87	14.10	14.17	8.94	8.92	9.03
0.25	0.11	0.12	0.13	0.18	0.19	0.19

Sample 1 – PartAn results compared to sieve results



Sample 2 – PartAn results compared to sieve results



The PartAn software saves every picture of each imaged particle and the operator can review the irregular particles after the measurement.

CONCLUSION

The advantages of the PartAn 3001 L Multi-Image:

- much more accurate particle size information
- much more accurate particle shape information
- amount of irregular particles
- filter functions for non round particles
- filter functions for length/thickness
- results comparable to sieve analysis without fitting
- for laboratory or online-operation
- online-system as complete solution