

almaak international GmbH



founded in 2008



IATF 16949 / ISO 9001
ISO 50001 / ISO 14001
EcoVadis silver status



60 years of experience in the production
Of recycled materials



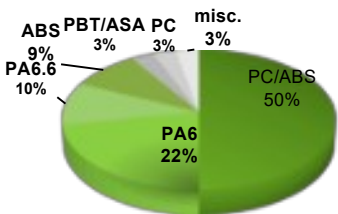
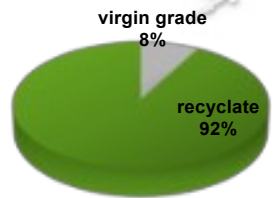
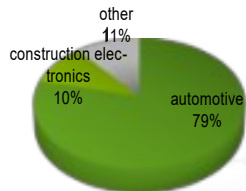
approx. 15.000 t/a CO₂-reduction
through almaak recycled materials



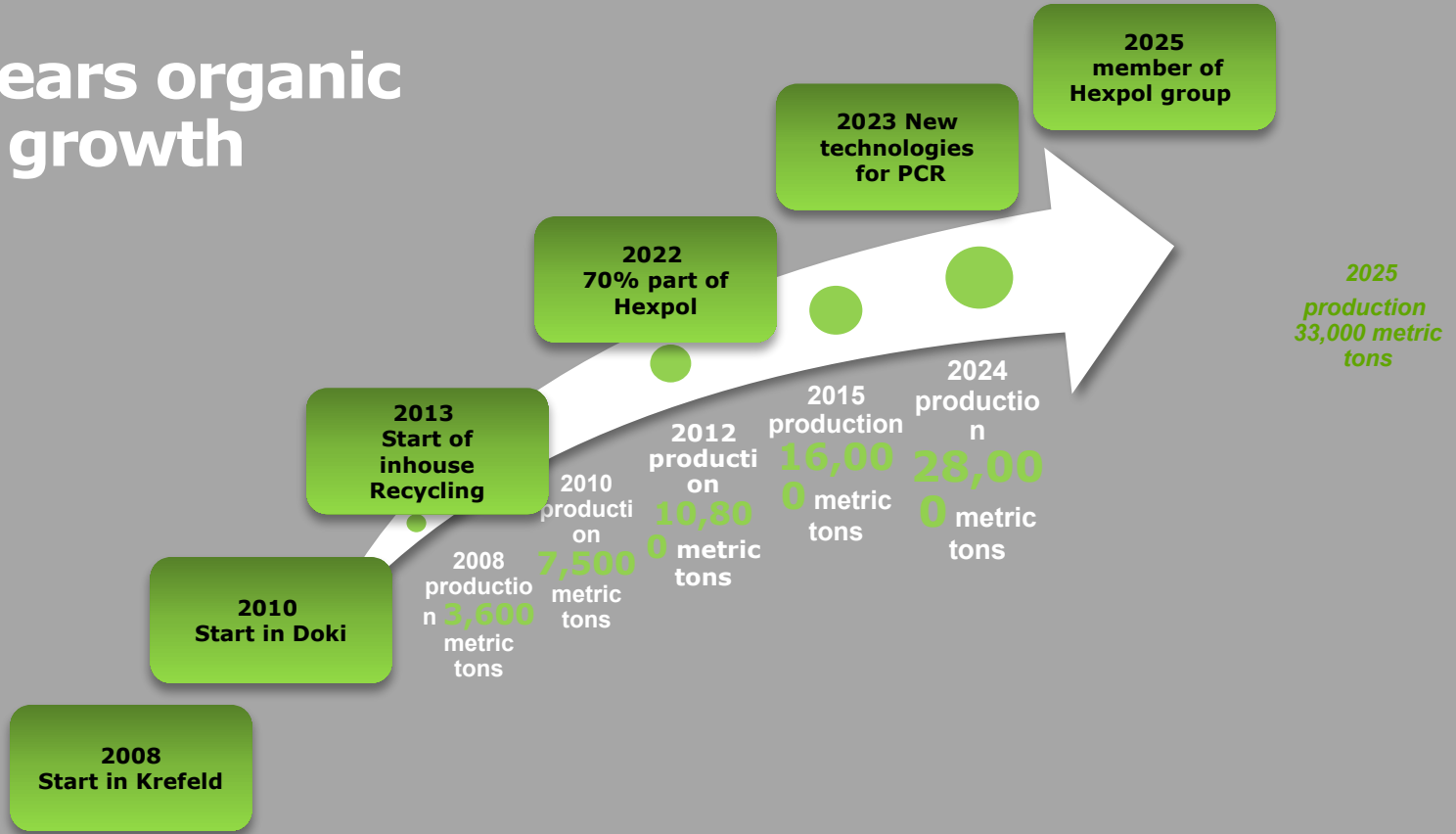
200 employees



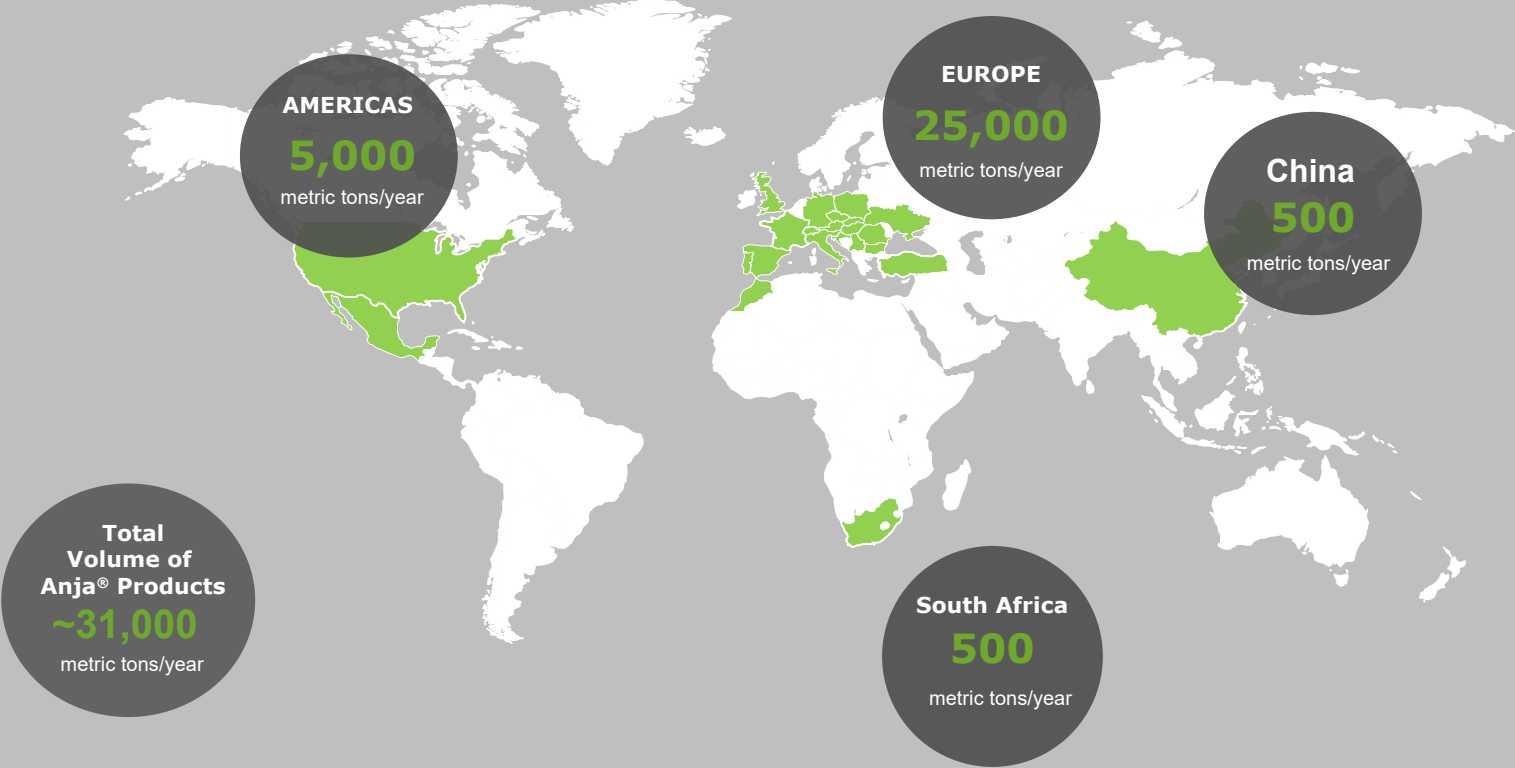
approx. 85 Mio € turnover



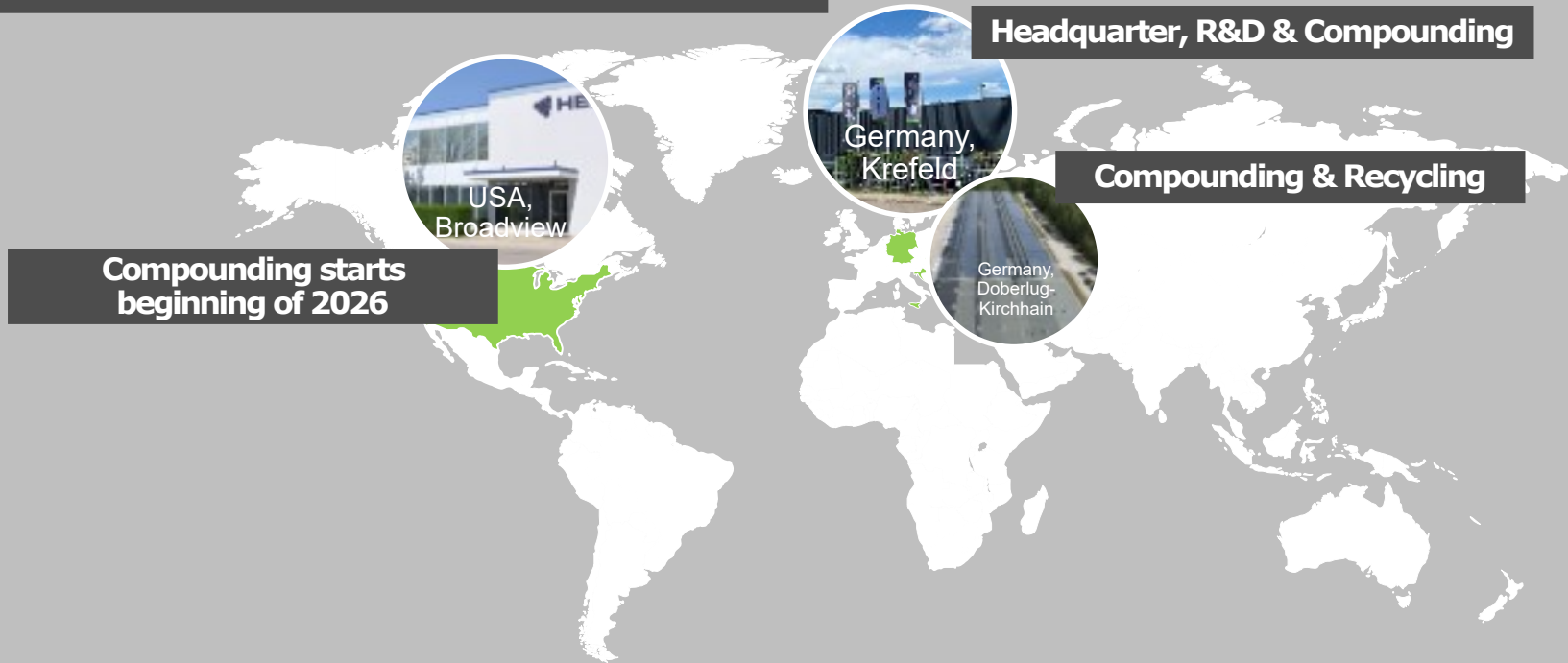
15 years organic growth



almaak sales



almaak production sites



Almaak in the Rotomolding-Industry:

1. McCann Plastics part of Hexpol Group make powders for the Rotomolding Industry since several decades
2. Beginning of 2025 it was decided to make these powders also in Europe under the roof of almaak's Doberlug-Kirchhain facility in between Berlin and Dresden
3. Rotopol & Kuteno 2025 were the first events to present us to the market
4. Since October 2025 (K-Fair Düsseldorf) Burkhard Reck joined as a Sales Manager for the market
5. Since then we are serving the market with material

Particle characterization for rotomolding powders using fast video imaging with MICROTRAC CAMSIZER X2



Challenges in Particle Analysis

Many quality problems arise not from lack of measurements, but from, incomplete or unrepresentative particle information

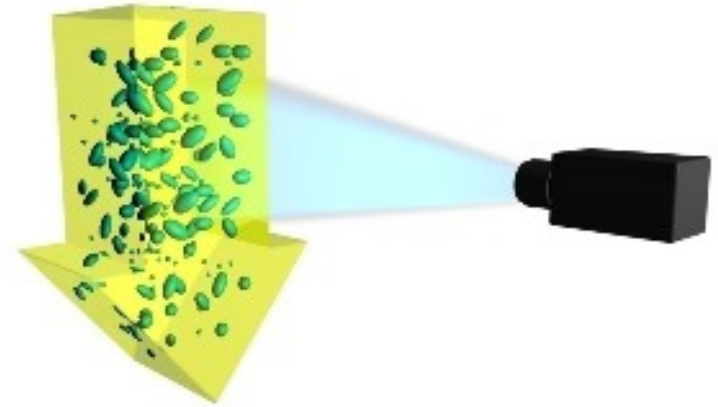


- Limited particle counts lead to insufficient statistical relevance
- Particle shape information often missing
- Oversize and fines difficult to detect reliably
- Limited comparability between different methods
- High operator dependency and long analysis times

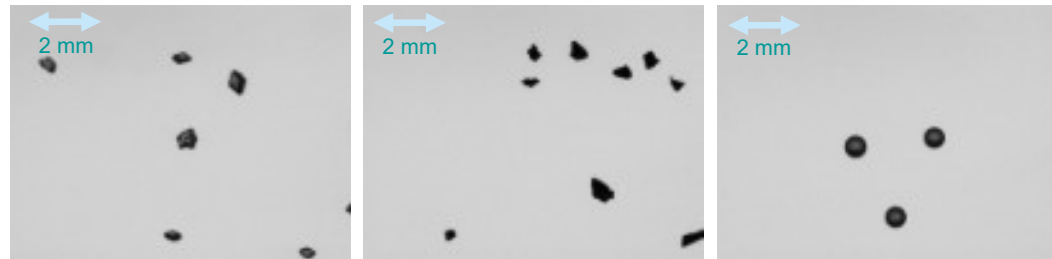
Why Dynamic Image analysis

Dynamic Image Analysis (DIA) closes the gap between particle size, particle shape and statistical reliability.

- Simultaneous measurement of **size and shape**
- Hundreds of thousands to **millions** of particles per measurement
- Wide **size range** in a single run
- **Real** particle images → **realistic** results:
„What you see is what you measure“
- Results within **minutes**
- Ideal for R&D, production and QC



DIA example images:



sugar crystals

activated carbon

glass beads

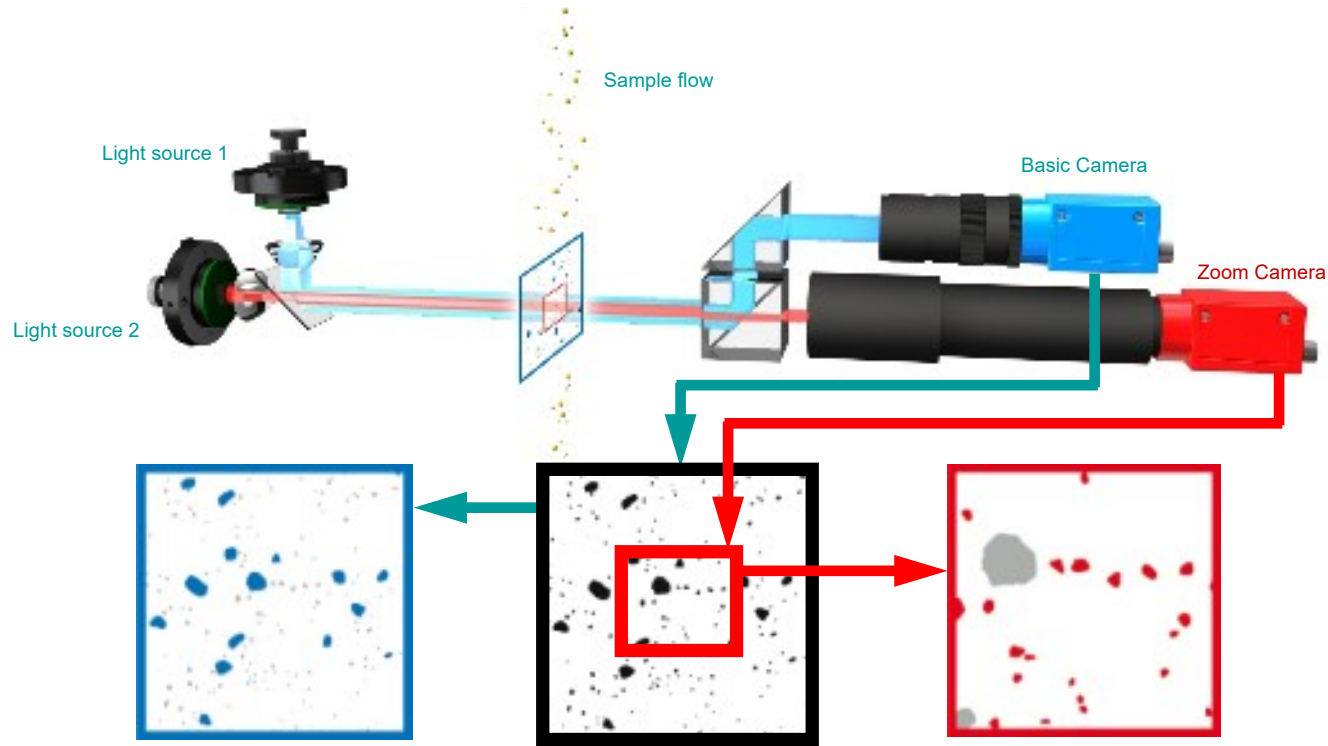
CAMSIZER X2+

The **CAMSIZER X2+** is a high-performance dynamic image analysis system for **dry and wet** particle characterization.

- Suitable for powders, granulates and suspensions
- Measurement range 0.9 μm – 8 mm
- Flexible dispersion concepts for different materials
- One optical setup - no hardware changes required
- Routine-ready operation with advanced analysis software
- Optional AI-based particle

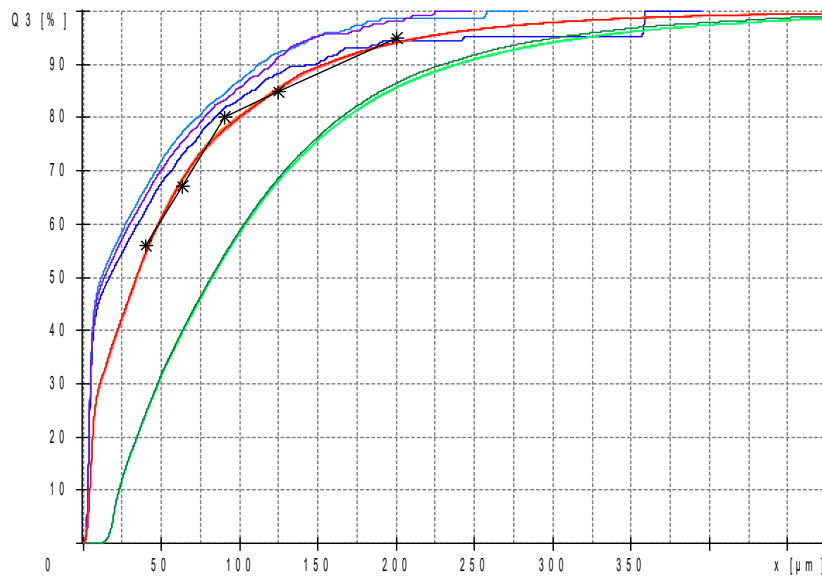


Dual camera technology



- Two cameras operate simultaneously
- Each camera optimized for a specific size range
- Separate illumination for maximum contrast
- Seamless overlap ensures consistent statistics

Why a Dual-Camera System Is Essential



- Single-camera systems bias particle size distributions
- Dual-camera design ensures correct representation of fines and coarse particles
- Excellent agreement with reference methods (e.g. sieving)

Analysis of a CaSO_4 sample with a wide distribution, 1 μm – 500 μm with CAMSIZER X2+

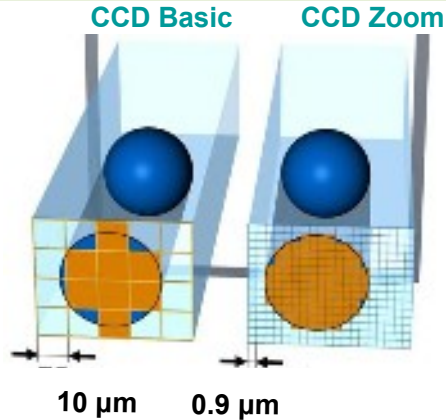
RED: CAMSIZER X2, 3 runs with BASIC & ZOOM

BLUE: CAMSIZER X2, 3 runs ZOOM-Camera only – Too many fines, poor repeatability for large particles

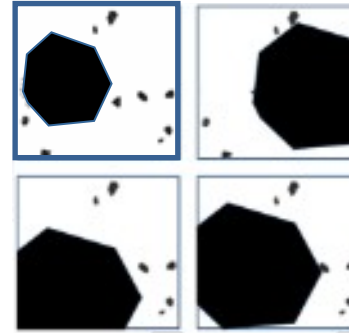
GREEN: CAMSIZER X2, 3 runs BASIC-Camera only - great repeatability, BUT: fine particles are not detected

BLACK: Sieve Analysis

Measurement range and physical limits



Lower measurement limit defined
camera resolution



Upper measurement limit defined by
the field of view

- Lower size limit defined by camera resolution (pixel size)
- Upper size limit defined by image field and edge effects
- Reliable evaluation requires complete particle images
- Dual-camera design maximizes usable measurement range

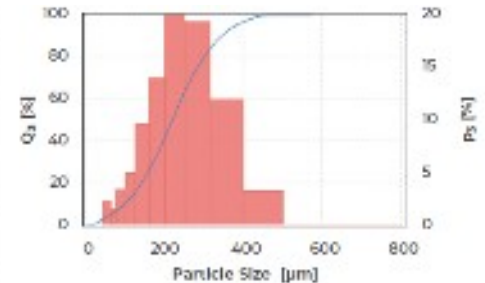
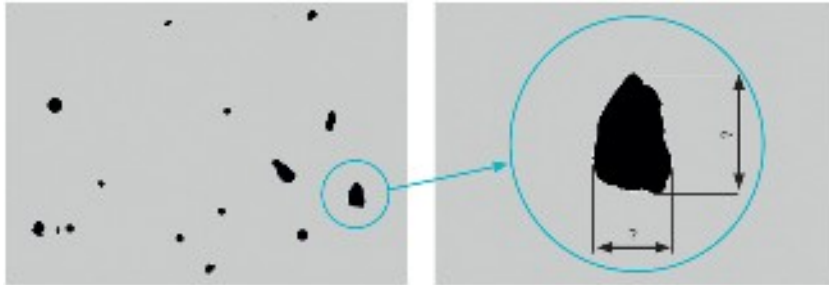
Requirements for DIA are
described in ISO 13322-2

What does the camsizer x2+ measure

From raw data image to meaningful measurement results

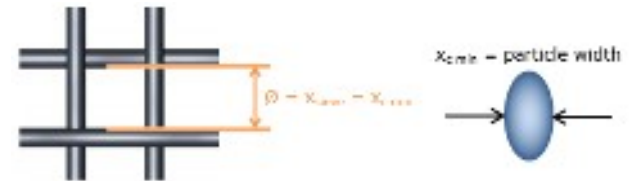
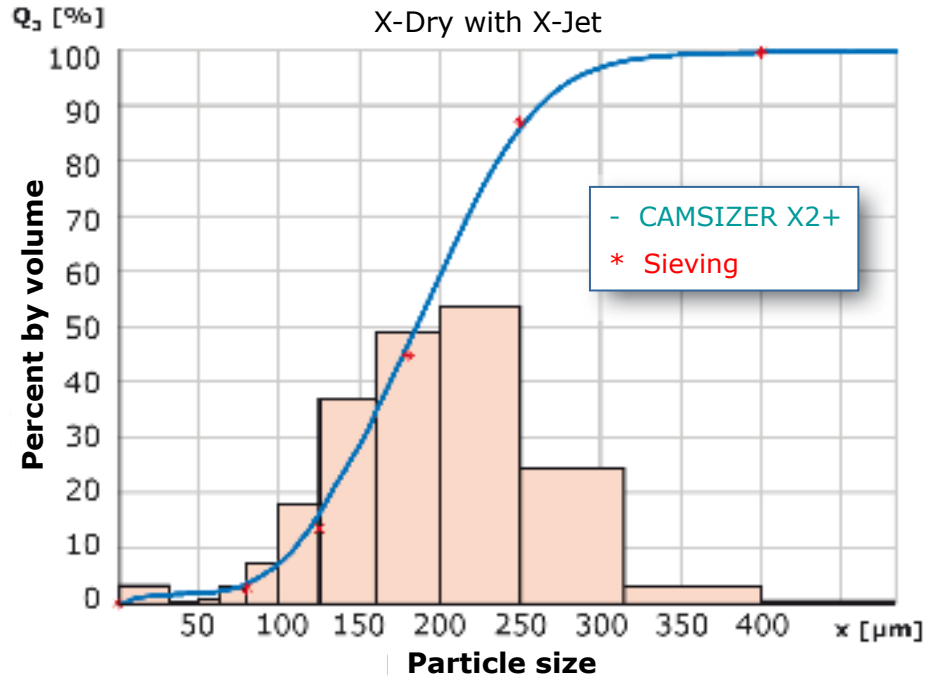
- Individual particle images
- Multiple size definitions per particle
- Shape parameters from real silhouettes
- Statistically representative distributions

Particle size is not a single value – Size results depend on the chosen size parameter



CAMSIZER X2+

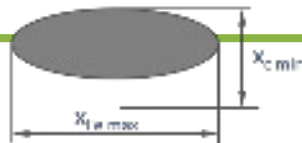
Identical results with sieve analysis



Particle shape definitions

- Aspect Ratio

$$\frac{x_{\text{c min}}}{x_{\text{c max}}}$$



- Circularity

$$\sqrt{\frac{4\pi A}{P^2}}$$



P = Perimeter
A = Area

- Symmetry

$$\frac{1}{2} \left(1 + \min \left(\frac{r_1}{r_2} \right) \right)$$



- Convexity

$$\sqrt{\frac{A_{\text{real}}}{A_{\text{convex}}}}$$



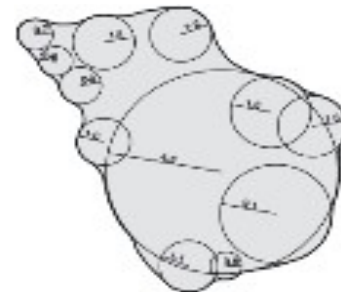
- Compactness

$$\frac{\sqrt{\frac{4A}{\pi}}}{x_{\text{c max}}}$$



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26



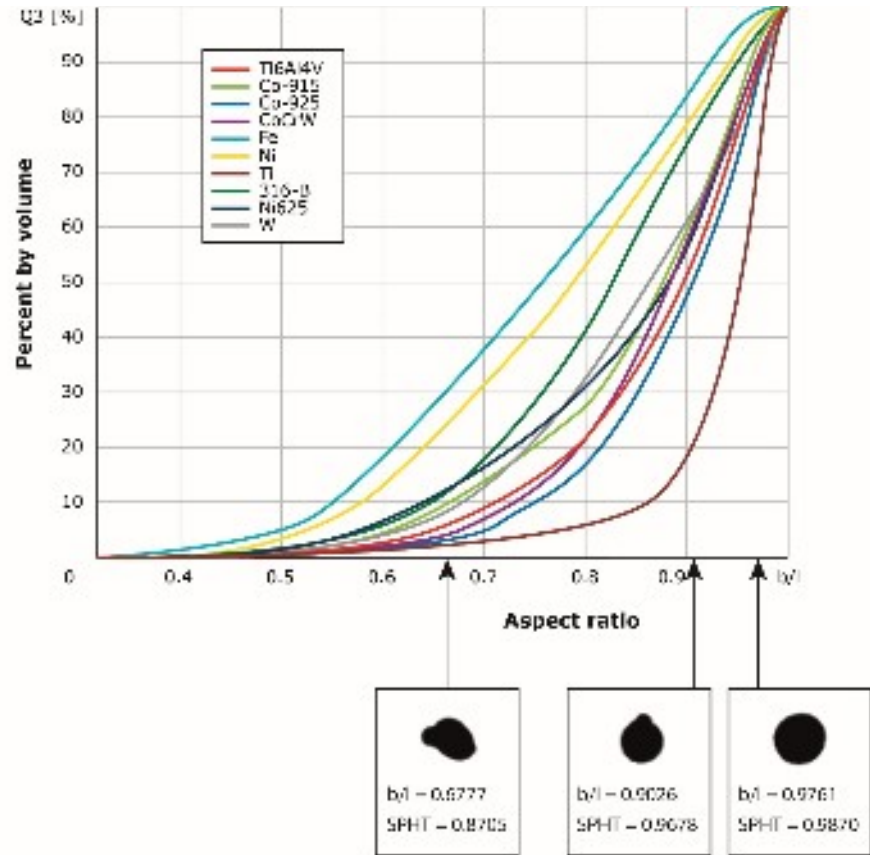
- Roundness $RDNS_C$
Mean radius of the corners divided by the radius of the inner circle

Shape analysis: Metal powders

These metal powders for additive manufacturing are in a size range 20 - 60 μm .

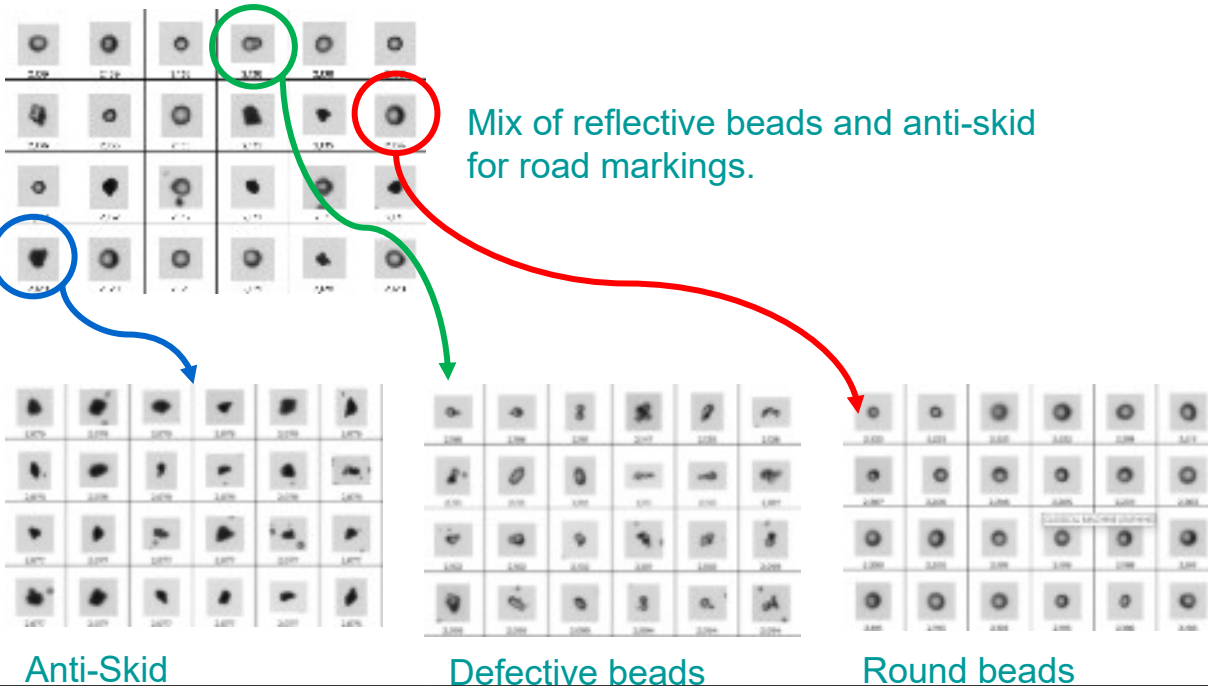
Particle shape strongly influences:

- Flowability
- Packing density
- Mechanical stability
- Dissolution and reactivity

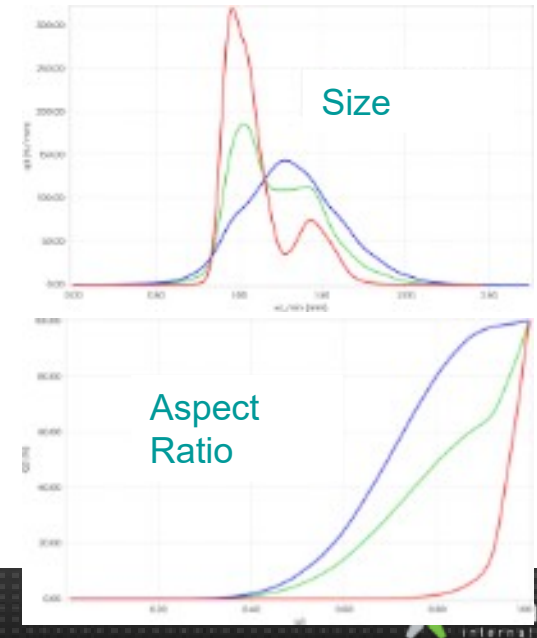


AI Classification: Road markings

AI can identify, quantify, and separately evaluate components in a mixture.
Runs on every CAMSIZER that uses DIMENSIONS Software



Antiskid/abrasives
Round glass beads
Mixed sample

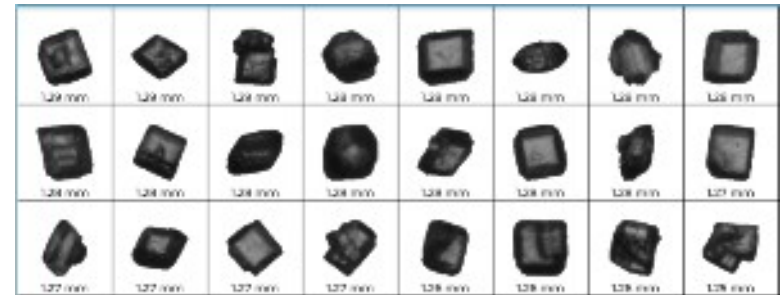


AI Classification: Sugar Contamination

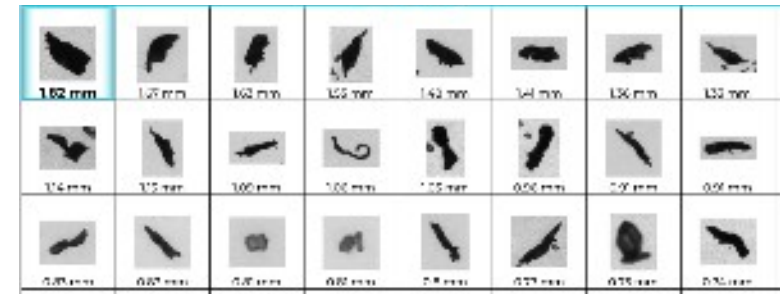
AI classification builds on reliable particle measurement – it does not replace it.



- Sugar with metal particles from abrasion of production machinery.
- Contaminants are removed using metal separators.
- The CAMSIZER AI can determine whether even the smallest amounts of metal are still present, thus improving product safety.
- It is even possible to narrow down the type and origin of the abrasion.

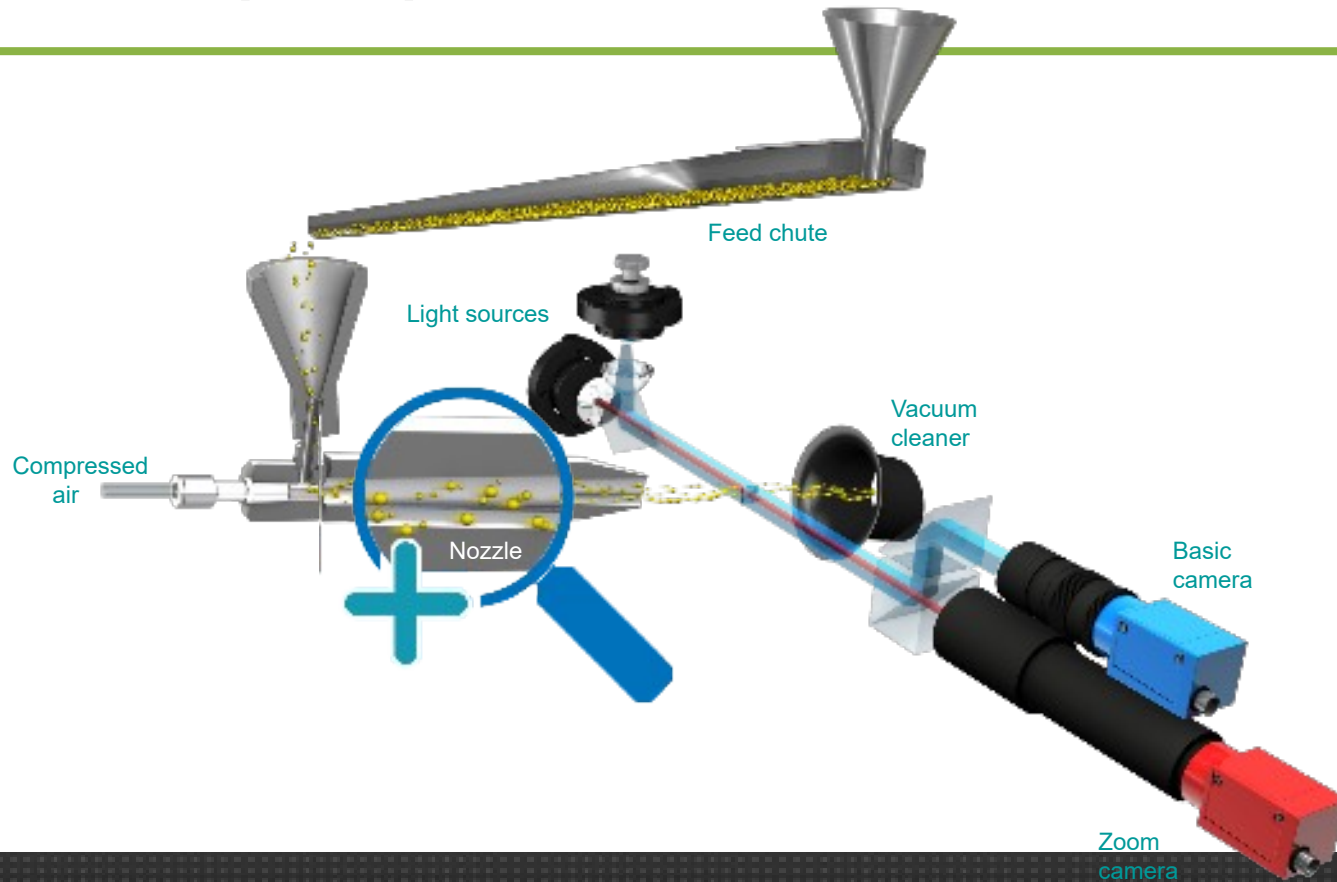


Sugar crystals.

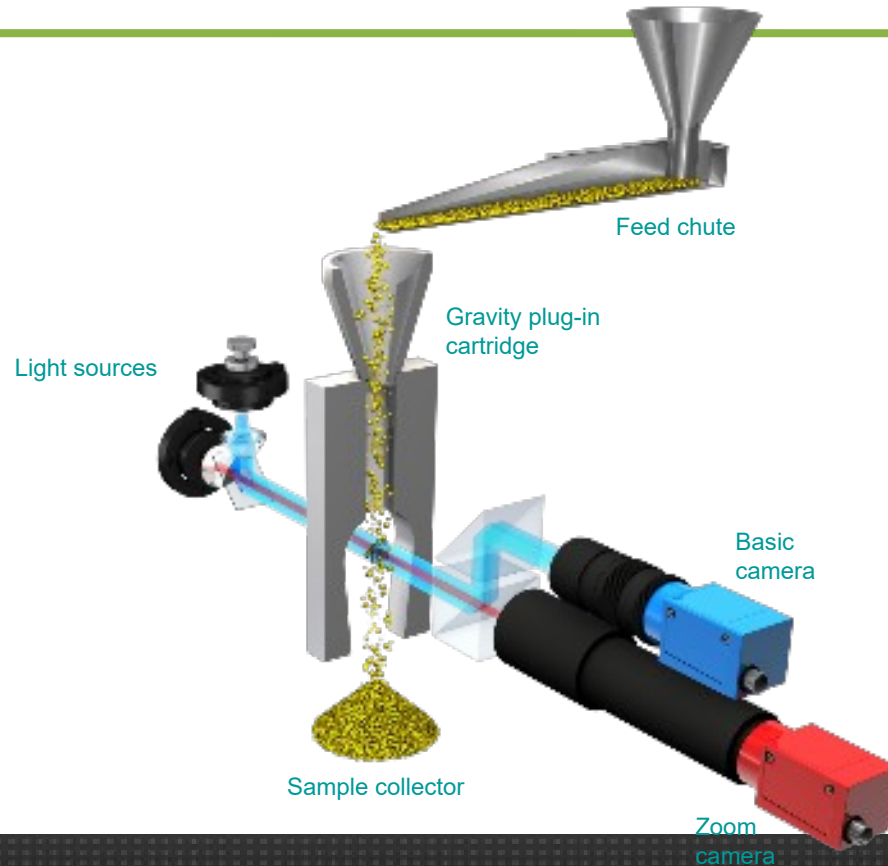


Metal contaminants

Measurement principle – X-Jet



Measurement principle – X-Fall



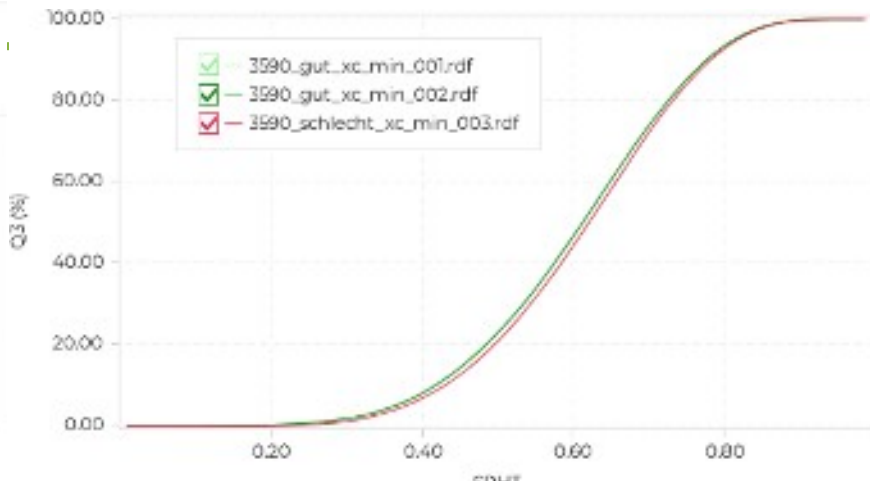
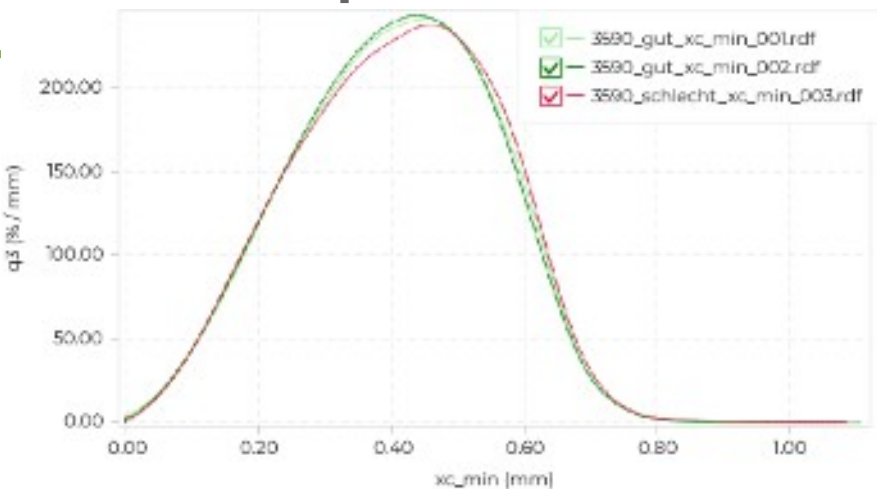
Applications and use cases

One instrument – many industries and materials

- Additive Manufacturing
- Battery Materials
- Chemicals
- Construction Materials
- Foods & Ingredients
- Glass & Ceramics
- Minerals, Mining & Geology
- Pharmaceuticals & Excipients
- PE-Powders for Rotomolding Industry



PE-Rotopowder: Detection accuracy for size and shape



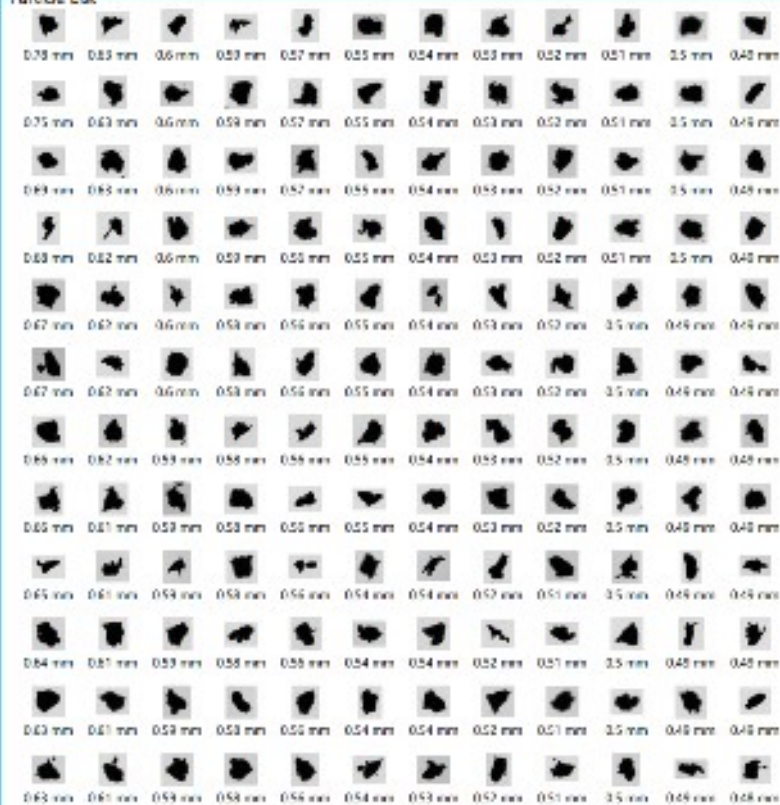
Data File	Size class			p3 (%)			Q3 (%)			SPHT3			b/13			PDN				
	File 1	File 2	File 3	File 1	File 2	File 3	File 1	File 2	File 3	File 1	File 2	File 3	File 1	File 2	File 3					
Method:	MRS718_almaak_alg	MRS718_almaak_alg	MRS718_almaak_alg																	
Time:	2/3/2026 10:34:54 AM	2/3/2026 10:45:13 AM	2/3/2026 11:03:17 AM																	
Duration:	3 min 58 s	4 min 25 s	3 min 57 s																	
Basic camera:																				
Particles:	1,067,084	918,809	820,704	0.100	0.125	1.25	1.27	1.26	3.02	3.02	2.84	0.708	0.706	0.724	0.581	0.579	0.582	52,464	52,924	51,955
Images:	50,836	68,945	51,977	0.125	0.160	2.48	2.55	2.59	5.50	5.57	5.43	0.693	0.692	0.705	0.572	0.571	0.571	51,427	52,128	51,937
Zoom camera:				0.160	0.200	4.04	4.11	4.16	9.54	9.68	9.59	0.680	0.680	0.688	0.570	0.571	0.567	41,262	41,695	41,410
Particles:	504,834	344,213	216,642	0.200	0.250	6.91	6.97	6.97	16.45	16.65	16.56	0.665	0.665	0.670	0.573	0.573	0.568	36,557	36,530	35,628
Images:	50,329	68,551	51,512	0.250	0.315	11.71	11.90	11.51	28.16	28.55	28.07	0.649	0.647	0.650	0.580	0.578	0.570	32,459	32,368	30,530
Q10 = 10.00 %:	0.20385 mm	0.20296 mm	0.20336 mm	0.315	0.400	18.92	19.18	18.28	47.08	47.73	46.35	0.625	0.626	0.630	0.587	0.587	0.581	26,529	26,699	24,827
Q10 = 50.00 %:	0.41226 mm	0.40909 mm	0.41582 mm	0.400	0.500	24.15	24.25	23.67	71.23	71.98	70.02	0.604	0.606	0.613	0.605	0.607	0.602	17,942	17,863	17,082
Q10 = 90.00 %:	0.59418 mm	0.58905 mm	0.59748 mm	0.500	0.630	23.54	23.00	24.42	94.77	94.98	94.44	0.587	0.586	0.606	0.647	0.646	0.652	10,174	9,884	10,292
Q100 (2500 mesh):	3.02 %	3.02 %	2.84 %	0.630	0.800	5.12	4.92	5.46	99.89	99.90	99.90	0.557	0.554	0.577	0.687	0.686	0.694	1,381	1,304	1,456
Mean(Sx):	0.40548 mm	0.40295 mm	0.40008 mm	0.800	1.000	0.11	0.10	0.10	100.00	100.00	100.00	0.372	0.379	0.389	0.636	0.627	0.652	15	13	14
Sigma(Sx):	0.14717 mm	0.14825 mm	0.14839 mm																	
SPAN3:	0.947	0.948	0.948																	
US:	2.226	2.222	2.253																	
usmax(1g):	0.45881 mm	0.44861 mm	0.44307 mm																	

PE-Rotopowder: Particle Images

1902_rot_003 particles

Size definition: cc min

Particle List



1902_rot_003 particles

Size definition: cc min

Particle List



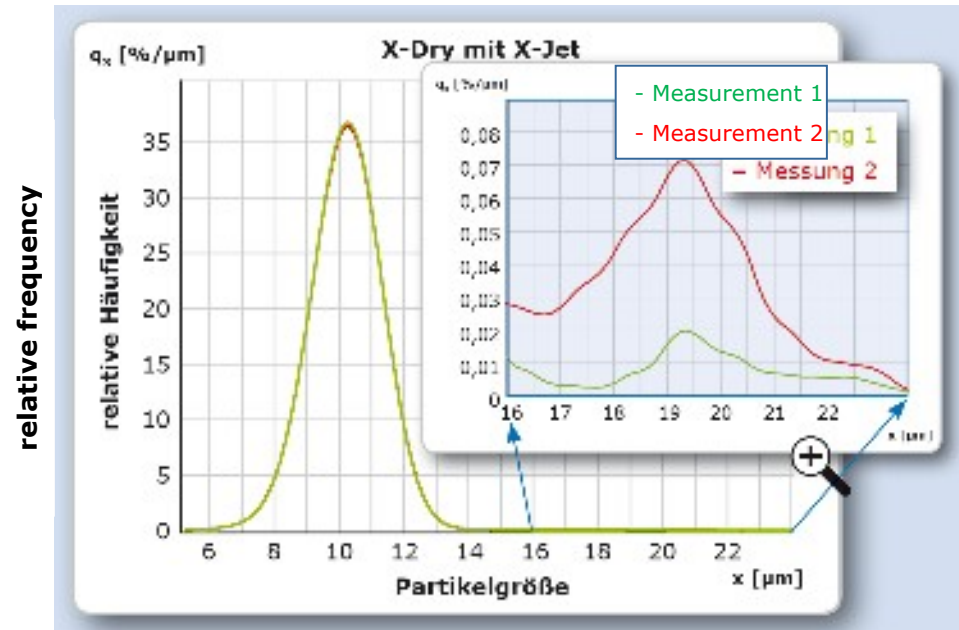
Oversize detection

Oversize particle determination is crucial in many areas:

- Large particles damage the surface being processed (abrasives),
- lead to product failure (building materials), or
- impair product performance (batteries).

CAMSIZER can detect even the smallest amounts of oversized particles, down to 0.005 % (depending on sample quantity)

Detection of oversized particles



particle size

Sample: PMMA beads

Particle Size analysis methods

Technique	Method	Output
Sieve analysis	Mechanical separation	Mass-based size distribution
Laser diffraction	Light scattering	Equivalent Sphere Diameter (ESD)
Static image analysis	2D images (limited FOV)	Size & shape (limited statistics and narrow size range)
Dynamic image analysis (CAMSIZER X2+)	Flowing particles + imaging	Size & shape with high statistics and wide size range



CAMSIZER X2+ and Sieve Analysis

Image analysis extends sieve analysis – without losing comparability - Safe, fail-free, user-independent

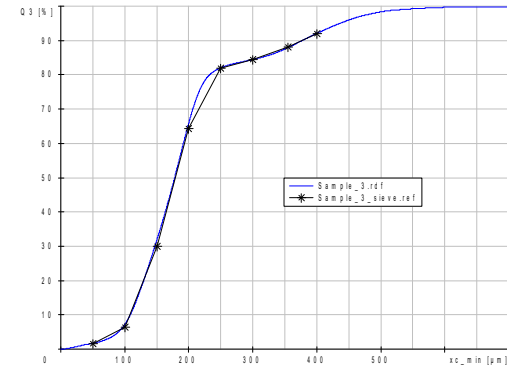
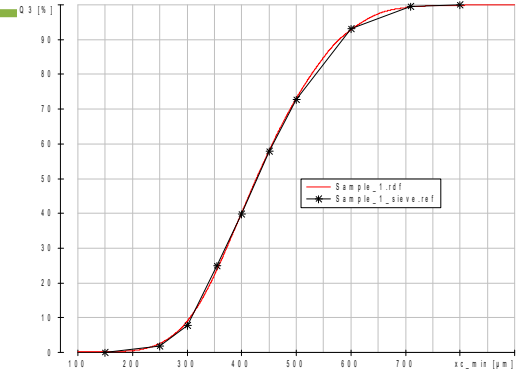
Works for mono- and multimodal samples (black asterisks = sieve result, red / blue = CAMSIZER X2+ result)

Sieve Analysis

- Robust, established
- Limited size resolution (typically 8 sieves)
- No shape information
- Time-consuming

CAMSIZER X2+

- Comparable size concept ($x_{c, min}$)
- Continuous size distribution
- Size **and** shape
- Fast, automated measurement



Why not static image analysis?

Static image analysis is an “automated microscope”

Dynamic imaging enables statistically relevant measurements.

Static Image Analysis

Limited number of particles

Manual sample preparation

Risk of selection bias

Often slow

Dynamic range max. factor 100

CAMSIZER X2+

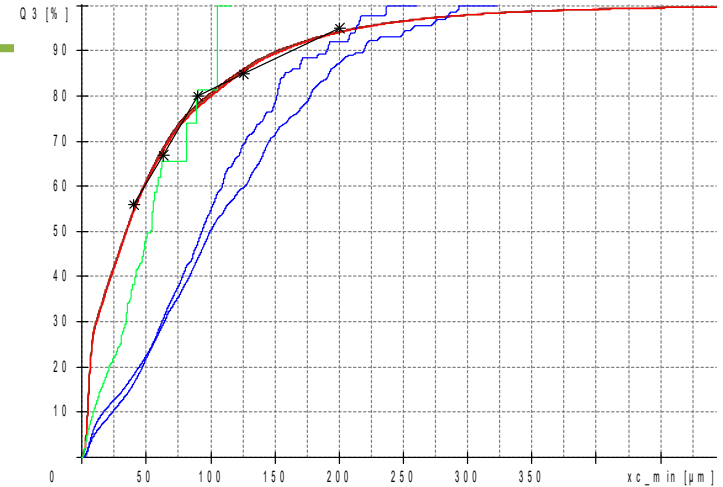
Millions of particles

Automated particle flow

Representative statistics

High throughput

Dynamic range > factor 5000



Analysis of a Gypsum sample

Red: CAMSIZER X2+

Blue: Microscope with 10 x magnification

Green: Microscope with 50 x magnification

Black: Sieve result

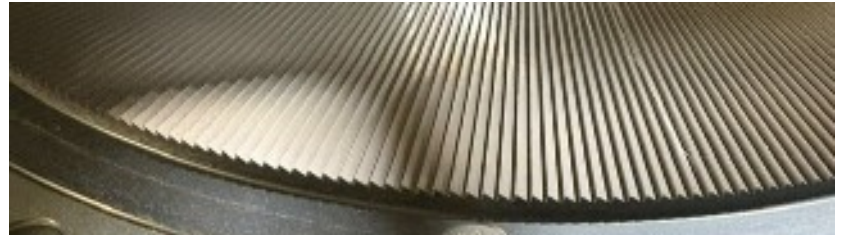
Note: „bumpy“ curve and bad repeatability due to low particle count. The results don't match sieve analysis

Advantages

- Dynamic Image Analysis with patented 2-camera system (ISO 13322-2)
- Wide dynamic range from 0.9 μm to 8 mm
- Newly developed optical system with ultra bright LEDs for sharp contrasts and large depth of focus
- Short analysis time 1 – 3 minutes for few million particles
- Safe detection of oversized and undersized particles
- Modules for dry and wet dispersion
- Analysis results optionally compatible to sieve analysis

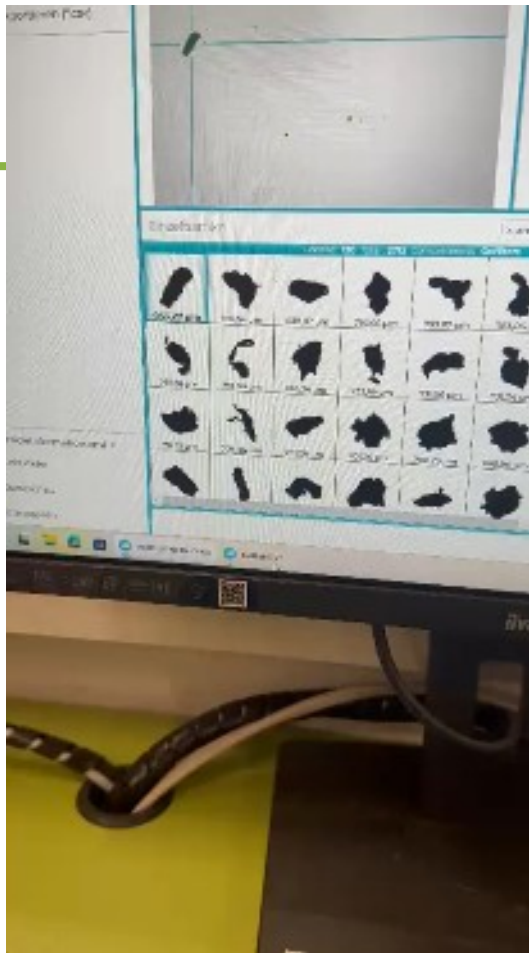
Results and conclusions for the Rotomolding Industry II:

- Particle analysis will replace traditional sieve analysis and flowability funnels... for much more detailed information about powder characteristics at the end it is all about the conditions of grinding discs (cutting angle and wear)



Results and conclusions for the Rotomolding Industry:

- Flowing and quality properties of Rotomolding PE-Powders can not be sufficiently rated by sieve analysis
- Every particle and the particle structure and shape will count for the flowing properties
- Particles have to be squared, or round to flow as expected, if particles become long, the flowability become poor
- Particle shape is dependent of the wear and technology of milling discs
- Fine particle content acts as lubricant, if the fine content (below 0,1mm) will disappear the flow properties will also become poor
- Cam Sizer Analysis will also replace the traditional sieve analysis and will reduce manual workload
- The particle shape will change during the wear of the milling discs



Particle Analyzer CAMSIZER X2- Part icle analysis of spray dried powders | M ICROTRAC