Shape Characterisation of Alumina Catalysts Beds

Introduction

Porous Alumina powder in catalyst manufacturing is used as a carrier material on which the metal-catalyst is fixed to generate active sites. The particle size of Alumina is around 100 microns.
The shape of the Alumina powder is critical to the manufacturing process. If the Alumina particles are not spherical, they generate agglomerated lumps during manufacturing. These agglomerated lumps are useless as a catalyst. The amount of agglomerates depends on the sphericity of the Alumina powder and may be up to 25% of the total production.
An automated method for the determination of the sphericity of the Alumina powder is required.
Several Alumina samples were analysed with the Ankersmid DSA-10 to obtain Aspect Ratio distribution.

Instrumentation
The Ankersmid Dynamic Shape Analyzer, DSA-10, is a complete shape characterization system for particles in motion. Comprehensive particle analysis is obtained through the unique combination of a synchronous strobe light source and video microscope technology. All particles are fully classified by numerous shape parameters including Aspect Ratio (roundness).

Aspect Ratio = (Min Feret) / (Max Feret)

An automatic flow controller (LFC-101) is used to flow the particles through the measuring cell. A video microscope camera synchronized with strobe light captures frozen images continuously while particles are in dynamic flow. The images are enhanced, processed, and analyzed automatically to ensure full representation of the sample. Accurate results are produced in a fraction of the time normally required for microscopic observation.

Table 1 - Measurement set-up configuration

Illumination	Synchronized strobe light with adjustable intensity and duration.				
Video camera	High resolution B&W CCD camera, 768x493 pixels.				
Shape range	**Lenses**	**Objective magnification**	**F.O.V**	**µm/Pix**	**Range [µm]**
	Lens DW	6x	1500x1200µ	2.3	10-600

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Results

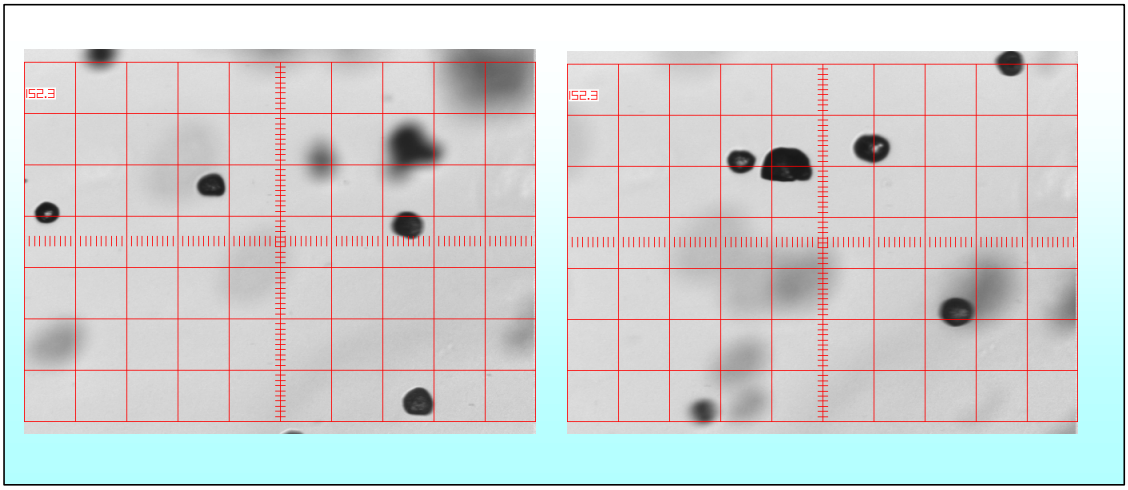

Fig. 1 – Images of Sample B13656

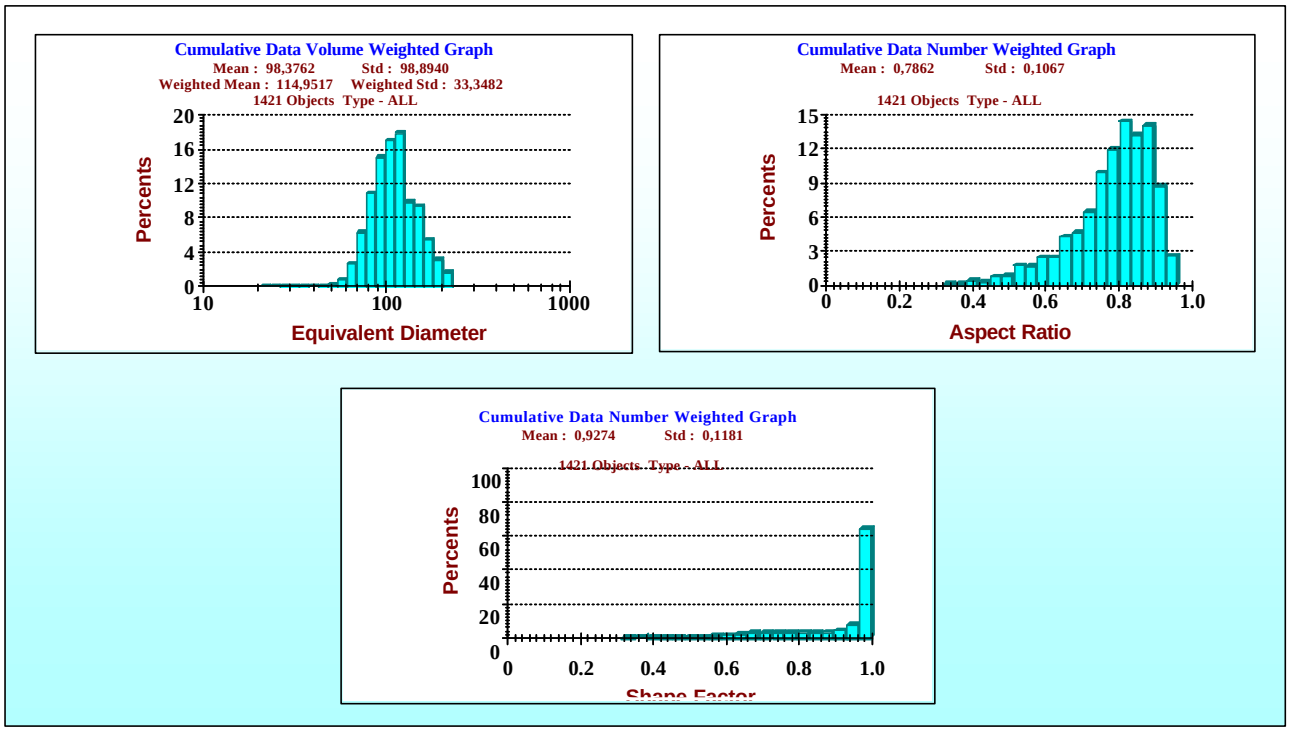

Fig. 2 – Equivalent diameter, Aspect Ratio and Shape factor of B13656

Batch #	Agglomerates (kg)	Aspect Ratio
B13653	192	0.7685
B13656	147	0.7862
B13664	150	0.7850
B13670	94	0.8034
B13679	131	0.7902
B14487	126	0.7935
B14492	99	0.8013
B14879	9	0.8347

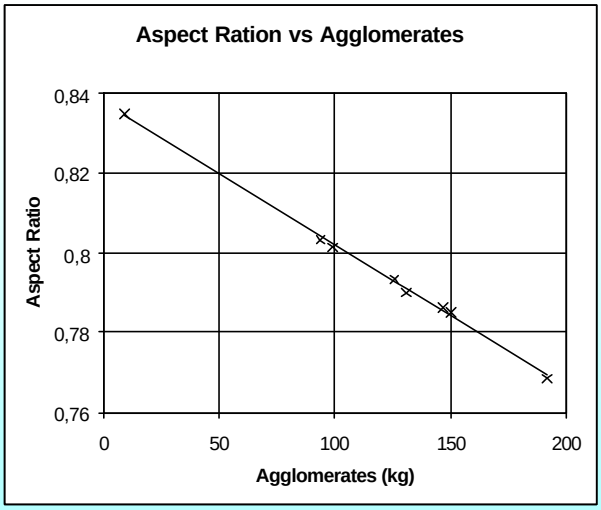

Fig. 3 – Aspect Ratio vs Agglomerates

Conclusion

The Aspect Ratio of Alumina is directly correlated to the amount of agglomerates produced during catalyst manufacturing. Dynamic Shape Characterisation provides a fast, reproducible method for the determination of the Aspect Ratio through automated image analysis.
With the Dynamic Shape Characterisation, Alumina and Catalyst manufacturers have a strong method to control the quality of their products.

References

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2. Karasikov, N.; Krauss, M.; Barazani, G., In *Particle Size Analysis,* Lloyd, P.J Ed.; John Wiley & Sons: New York **1988.**

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