AL16 - A Review of Powder Characterization

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Abstract

When a process modification involves a new, or a partly unknown material, it is very important to establish a good basis for the material characteristics. If a material sample is available it is possible to measure various material parameters and characterize the material perfectly. An accurate measurement of only a few material parameters will allow for a better selection of the necessary process steps for the material handling and selection of the right storage equipment. In this paper different ways to characterize powder and bulk material are introduced. This system is applied to a sample material, and to fractions of this material. Fractions of a material will behave differently compared to the complete material sample. The importance of a homogenous material for the design of the storage and handling system is discussed based on a simple schematic.

Keywords: Alumina handling, storage, material transport.

1. Introduction

A specialist company is requested by a plant operator or his planner to submit an offer for the construction of a sub-plant within a larger plant, e.g. a cement or aluminium producing plant. In addition to WHAT and FOR WHAT, the specifications attached to the request contains all basic requirements of the planned plant section. In the case of the bulk material processing plants considered here, this also includes the specification of basic bulk material parameters. However, these are generally limited to information on the average particle diameter, if necessary also the particle size distribution, the solid and bulk density as well as information on the chemical composition of the product entering the sub-plant. However, the bulk material behaviour changes along a process depending on the local handling/stressing situation, i.e. depending on the external forces acting on the bulk material in relation to the inter-particular forces, sometimes significantly. Furthermore, abrasion, grain destruction and/or segregation, operating temperatures deviating from the ambient conditions as well as the type and composition of the (gaseous) ambient medium have an additional influence on the actual bulk material behaviour. For a serious and reliable system project planning, the bulk material data listed in the specifications is therefore generally not sufficient. The specialist company inquired will therefore request a "representative" bulk material sample, quantity: $\gtrsim$10 dm^3, from the plant operator for their own laboratory tests and measure the product characteristics that are relevant to the task from their point of view.

2. Measuring of Bulk Material Properties

Figures 1 and 2 show the basic version of a dust test report, as used in a similar way by various specialist companies, for a sandy alumina.

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Dust test report I

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Name of Material	Alumina
Suppl. Designation	Sample from big bag before conveying
Chem. Designation	
Company, Plant	
Client / Order No.	
Code Word	

Test-No.: 14871
Of. in charge: Hilck
Date: 07/27/20
Tested by: Bardenhagen
Com.-No.: 02-5-255853

total moisture	106°C /22h	**0,06**	%	DIN 51718	screening machine: Alpine				
free moisture	24°C /58% /22h	**+2,20***	%	DIN 51718					
bulk density		**1,02**	kg/ dm³	DIN EN 459-2	residue R (mm) acc. to *DIN 66165-1, -2*				
vibrated density		**1,25****	kg/ dm³		d[mm]	R[%]		d[mm]	R[%]
raw density		**3,49**	kg/ dm³	DIN ISO 8130-2	16			0,315	**0,13**
angle of respose		**37,0**	°	DIN ISO 4324	10			0,2	**0,52**
diameter of max. particle		**390**	µm	DIN 66145	6,3			0,16	**1,78**
mean part. ⌀ d_{50} median value		**73**	µm	DIN 66145	3,15			0,125	**6,82**
mean particle ⌀ d'		**84**	µm	DIN 66145	2,0			0,09	**30,28**
RRSB slope α		**64,8**	°	DIN 66145	1,0			0,063	**61,47**
particle shape		**1,3,4*****		FEM 2582	0,6			0,045	**77,71**
Blaine figure	ε = 0,66	**1976**	cm²/g	DIN 66126-2	0,5	**0,07**		0,032	**87,77**

annotations
24°C/63%rH

Laser (RR): max. particle = 440,0 µm ; d_{50} = 69,7 µm ; d' = 93,5 µm ; α = 51,2° ;
*weight increases ; **remains pourable ; ***not agglomerated, often shape 4 ;
max. Grain is formed by foreign particles (slags, see photo).

RRSB-distribution
DIN 66145

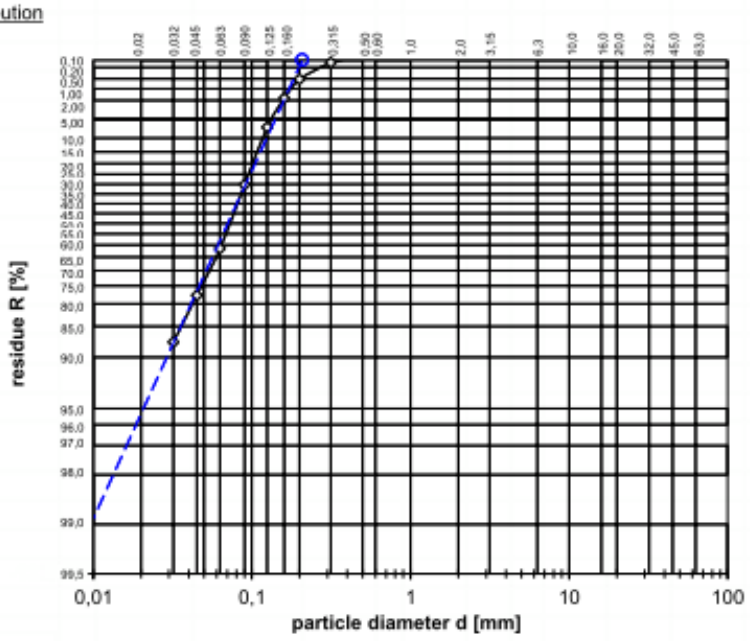

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Figure 1. Dust Test Report, Page 1: Particle size and densities.

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