

#### Flowability and Particle Size

#### The Manufacturer's Point of View

by Martin Stobik



## WHAT IS FLOWABILITY?

#### Fluid dynamics





#### No-slip condition fulfilled?

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#### Application











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## Is it measurable?



#### **Revolution-Powder-Analyzer**



Hall-Flow-Meter



**Ring-Shear** 



Dr. Dietmar Schulze Schüttgutmesstechnik

#### Hausner-Index



WS AAM MPIE, Düsseldorf

July 04, 2016

#### e.g. Hausner-Index





## Is it measurable? No!



#### Revolution-Powder-Analyzer



Hall-Flow-Meter



**Ring-Shear** 



#### Hausner-Index



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7



![](_page_8_Picture_0.jpeg)

![](_page_9_Picture_0.jpeg)

#### **PARTICLE SIZE**

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#### Particle size distribution

![](_page_10_Picture_1.jpeg)

![](_page_10_Figure_2.jpeg)

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#### It is the same powder!

![](_page_11_Picture_1.jpeg)

![](_page_11_Figure_2.jpeg)

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### Width of distribution

![](_page_12_Picture_1.jpeg)

![](_page_12_Figure_2.jpeg)

![](_page_13_Picture_0.jpeg)

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![](_page_14_Figure_0.jpeg)

### Air classification?

![](_page_15_Picture_1.jpeg)

![](_page_15_Figure_2.jpeg)

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#### Distribution 'as atomized'

![](_page_16_Picture_1.jpeg)

![](_page_16_Figure_2.jpeg)

![](_page_17_Picture_0.jpeg)

#### **OTHER INFLUENCES**

## Metastable phases

![](_page_18_Picture_1.jpeg)

Metastable phases can be frozen due to rapid solidification (RS)

![](_page_18_Picture_3.jpeg)

# Wait oranneal the powder

## Atomizing gas

![](_page_19_Picture_1.jpeg)

Nitrogen/air can have a surface hardening effect for better flowability

![](_page_19_Picture_3.jpeg)

➤Was nitriding steel your intention?

#### Oxide

Oxides can provide a hard surface for better flowability

#### Careful with the specification for oxygen. It can be too low!

![](_page_20_Picture_4.jpeg)

![](_page_20_Picture_5.jpeg)

# Humidity

![](_page_21_Picture_1.jpeg)

Water in the gaps between the particles will handicap flowability

![](_page_21_Picture_3.jpeg)

≻Keep the powder dry!

## **Fine particles**

![](_page_22_Picture_1.jpeg)

#### ≻do no harm!

![](_page_22_Picture_3.jpeg)

If they are not too many and if they are not too small. What is 'too small' and 'too many'?

![](_page_23_Picture_0.jpeg)

![](_page_24_Picture_0.jpeg)

# Thank you for your attention!