

Short Course on Powder Handling and Flow for Additive Manufacturing

April 22./23. 2020, at Fraunhofer IFAM, Bremen, Germany

- timeline -

Day 1

- 09:00 Intro from all
- 09:30 Wolfson Centre: Intro to powder behaviour
- 10:30 Coffee break
- 10:45 IFAM: Powders in the AM process – powder degradation during processing; overview of currently specified powder properties in standards and company specifications
- 12:00 Lunch – Restaurant “Platzhirsch” – 5 min walk
(paid by IFAM as part of course fees)
- 13:00 Tour of IFAM’s 3D Printing Facilities
- 13:30 Wolfson Centre - Basic introduction to handling processes
- Hoppers for storage/discharge: flow patterns, principles of reliable flow
 - Utilisation of powder flow properties
 - Pneumatic conveyors: Key components, features and operating issues
 - Fluidisation
- 14:30 Coffee break
- 14:45 IFAM: demonstration of powder characterization (done in two groups)
- bulk or apparent density determination (according to ASTM B 217/417)
 - flow rate determination (according to ASTM B 213/964)
 - tap or beat density determination (according to ASTM B 527)
 - particle size analysis (similar to ASTM B 822) and particle morphology measurement – RETSCH camsizer in action
- 17:00 Course closure day 1
- 18:30 Networking Dinner at a local restaurant in the historic city center
(paid by IFAM as part of course fees)

- details will follow during the short course -

Day 2 - see next page

Day 2

- 09:00 Wolfson Centre: Control of flow properties:
- Size, glidants, humidity, electrostatics etc
 - Powder formulation and conditioning - application and removal of moisture
 - Characterisation and control of powder properties:
 - What are powder flow properties
 - Various means for measurement of powder flow properties (Flow function, friction, density)
 - Use of Brookfield Powder Flow Tester for flow property testing of powder
 - Drop Tester for Bond Number Measurement of particles
- 10:30 Coffee break
- 10:45 Wolfson Centre: Quality issues; Basic overview of powder evolution and quality loss: Particle segregation, degradation, caking
- 12:15 Lunch – Fraunhofer IFAM
- 13:00 IFAM: demonstration of powder characterisation (done in two groups)
- Tumbling test or Rotating Drum test - Revolution Powder Analyser by Mercury - methods and challenges as well as analysis examples
 - trace analysis O-N-H/C-S
 - other powder test equipment
- 15:00 all: Discussion
- 16:00 Course closure day 2

After the seminar you will have the opportunity to visit MATERIALISE – an AM Metal Printing company - next door to Fraunhofer IFAM.

Presenters

Claus Aumund-Kopp, Group Leader for AM at the Fraunhofer IFAM Institute in Bremen, has worked with metal powders for AM powder bed fusion and AM binder jetting approaches for over fifteen years.

Richard Farnish, Senior Consulting Engineer at the Wolfson Centre, has worked internationally on design and troubleshooting of bulk solids handling as a commercial consultant and research expert for over twenty years.