

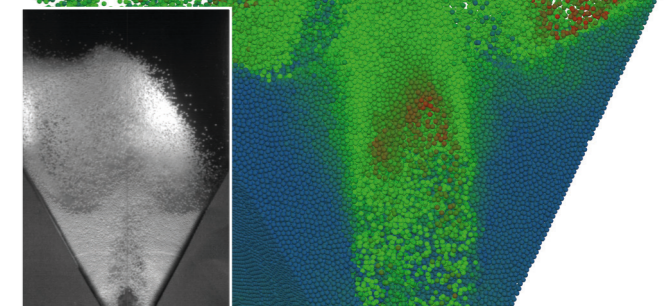
# University Course Fluidization Technology

Fundamentals and Applications in Drying,  
Granulation and Agglomeration

November 7<sup>th</sup> - 10<sup>th</sup>, 2016  
in Hamburg, Germany

#### Organized by

- Prof. Stefan Heinrich, Hamburg University of Technology  
Institute of Solids Process Engineering and Particle Technology
- Prof. Evangelos Tsotsas, Otto von Guericke University Magdeburg  
Chair of Thermal Process Engineering
- Forschungs-Gesellschaft Verfahrens-Technik e.V. (GVT)



#### Contact

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www.tuhh.de/spe

#### Date and venue

TuTech Innovation GmbH  
Harburger Schlossstrasse 6-12  
21079 Hamburg, Germany  
Phone +49 40 76629-0

**Start** Monday, November 7<sup>th</sup>, 2016, 1:00 p.m.

**End** Thursday, November 10<sup>th</sup>, 2016, 3:00 p.m.

#### Attendance

To register, please either fill out the enclosed form or by informal letter to

#### Forschungs-Gesellschaft

Verfahrens-Technik e.V. (GVT) Phone +49 69 75 64-118  
Theodor-Heuss-Allee 25 Fax +49 69 75 64-437  
6486 Frankfurt am Main, Germany gvt-hochschulkurse@gvt.org  
www.gvt.org

#### Course fee

1525 Euro for members of GVT

1600 Euro for non-members of GVT

The participation fee includes extensive course-ware (lecture and practical course material), refreshments and dinner at the 2nd and 3rd evening.

The course fee can be transferred after the official confirmation of participation by GVT. The course fee is tax free in Germany (§ 4 (22) UStG-MWSt.). Cancellations until October 25<sup>th</sup>, 2016 are free of charge. Thereafter no refunding is possible, however another participant can be denominated.

#### Accommodation

Hotel Panorama (15 min. walking distance) will guarantee room reservations until October 25<sup>th</sup>, 2016.

Single room 92 Euro

Keyword: University course Fluidization Technology

Phone +49 40 76695-0

www.panorama-hotels-hamburg.de

## Course program

#### Introduction to fluid-mechanical principles

- Operation limits, elutriation and state diagrams
- Dimensioning of gas distributors
- Practical fluidization experiments in the laboratory

#### Local fluid mechanics

- Bubble development, growth and coalescence
- Gas jets in fluidized beds
- CFD modeling of the fluid mechanics
- DEM/CFD modeling of the fluid mechanics

#### Methods for the characterization of fluidized beds

- Particle attrition and mechanical strength
- Breakage behaviour of granules and agglomerates
- Particle velocity and particle concentration
- Practical particle characterization experiments in the laboratory

#### Heat transfer in fluidized beds

- between fluid and particles
- between fluidized bed and internals
- Influence of backmixing and bubbles
- Cooling and heating of solids (batch, continuous)

#### Mass transfer in fluidized beds

- between fluid and particles
- Drying of solids (batch, continuous)
- Practical drying experiments in the laboratory

#### Vacuum drying in fluidized beds

- Fundamentals and modeling
- Equipment

#### Fundamentals of granulation and agglomeration

- Adhesive forces and binding mechanisms
- Influence of material properties

#### Fluidized bed spray granulation

- Fundamentals, kinetics and micro-mechanisms
- Operation regime maps
- Modeling of granulation (batch, continuous)
- Modeling of apparatus configurations and scale-up (Wurster-coater, top vs. bottom spray, spouted bed, rotor granulator)
- Processes, design options and equipment
- Practical granulation experiments in the laboratory

#### Flowsheet simulation of complex solids processes

- Introduction
- Flowsheet simulation of continuous fluidized bed drying
- Flowsheet simulation of batch and continuous fluidized bed spray granulation
- Multi-scale simulation of fluidized bed spray granulation

#### Participant

Mr.  Mrs.

#### Invoice address

**Registration form** for the University Course on Fluidization Technology from November 7<sup>th</sup> - 10<sup>th</sup>, 2016, in Hamburg  
**Deadline** October 25<sup>th</sup>, 2016. Participation is limited. Registrations will be confirmed on a first come first serve basis.

Fax +49 69 75 64-437

Surname

Company

First name

Department

Title, Position

Address

Company

Place

Phone, Fax

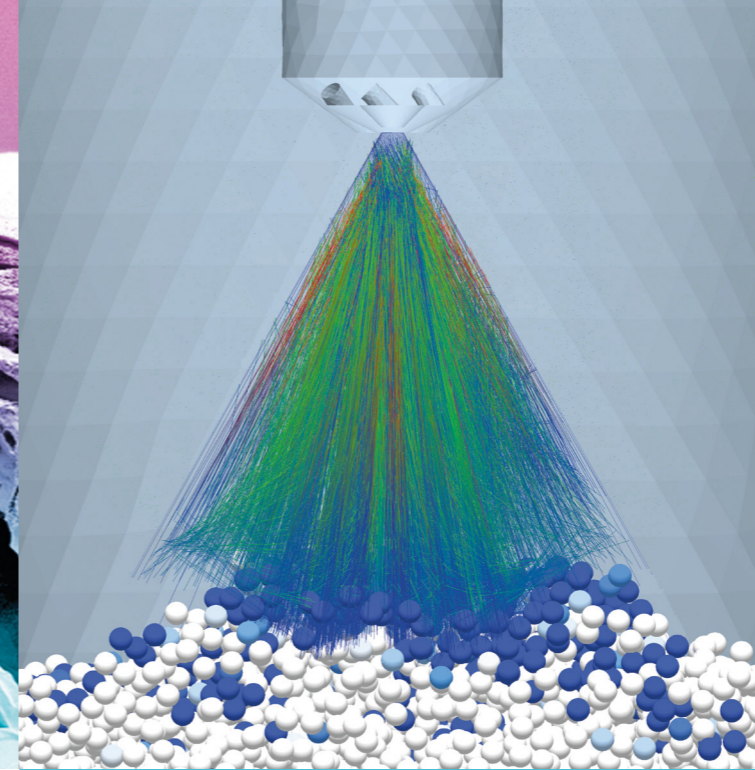
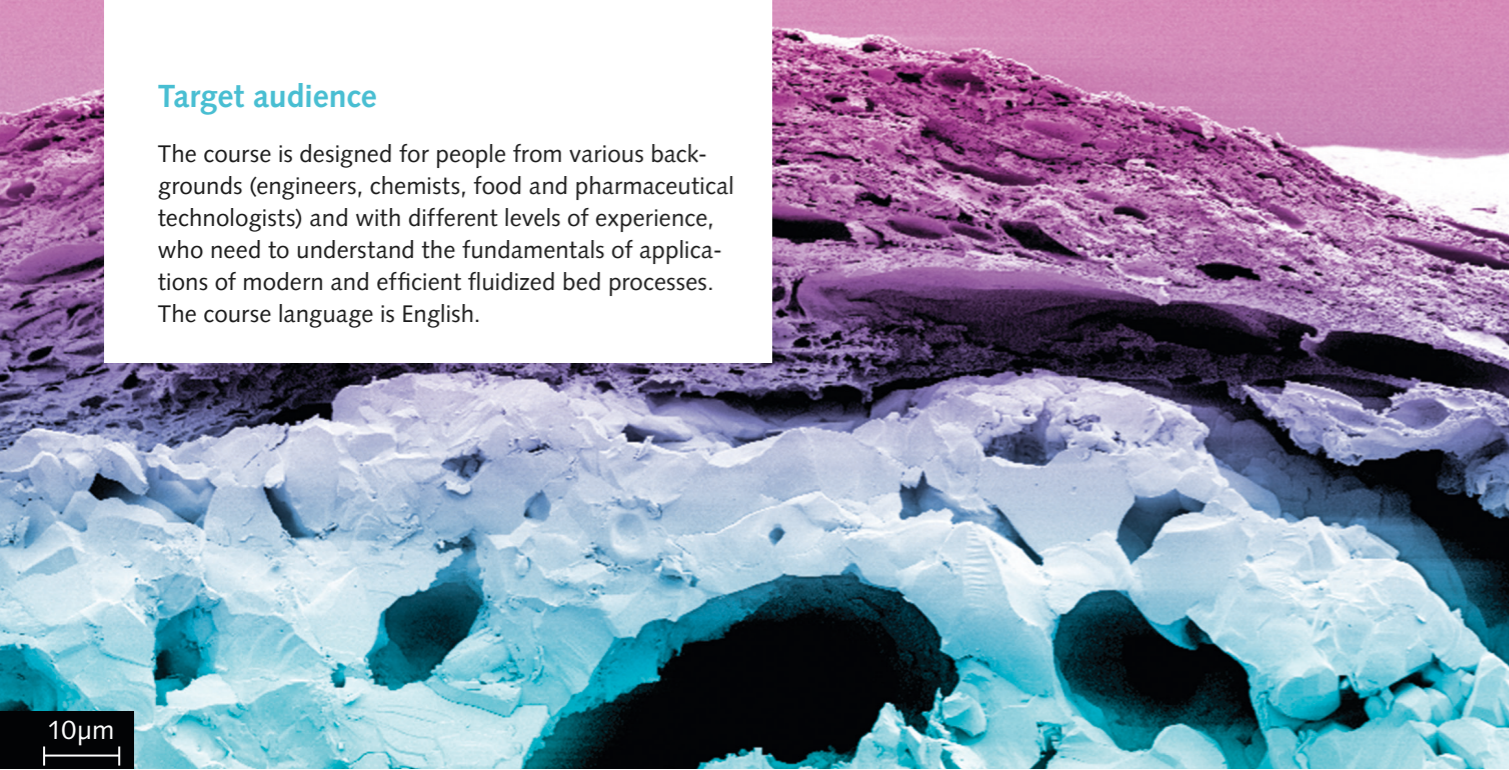
Company is GVT-member

E-mail

yes  no

## Target audience

The course is designed for people from various backgrounds (engineers, chemists, food and pharmaceutical technologists) and with different levels of experience, who need to understand the fundamentals of applications of modern and efficient fluidized bed processes. The course language is English.



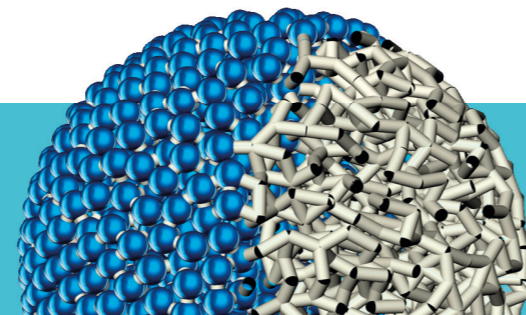
## Topic

Fluidization technology is used for a wide range of physical and chemical processes like classification, drying, adsorption, heating and cooling of solids, combustion, pyrolysis, carbonization, gasification, calcination or gas-solid reactions.

In this course we focus on the drying as well as on the spray granulation and agglomeration in fluidized beds. The particle formulation processes play an important role in the manufacturing of powder granules from liquid educts in the food, fine chemicals, biotechnological and pharmaceutical industries as dust-free and free-flowing particles with a defined particle size distribution can be produced in a process with favorable heat and mass transfer conditions and good solids mixing. Some of the further motives to use this size-enlargement process are the improvement of

appearance, taste and odors of particles or protection from oxygen, humidity, light or incompatible active agents and to control the dissolution time.

This course highlights the fundamentals and applications of various fluidized bed processes for drying, granulation and agglomeration of particles with practical hints and extensive calculation examples. The focus is on fluid mechanics, mixing, heat and mass transfer and particle formulation mechanisms. Furthermore, actual applications as well as modern computational tools and measuring techniques are presented. Practical process demonstrations in the laboratory and tutorials will strengthen the acquired knowledge.



## Speakers

### From the Hamburg University of Technology

Prof. Stefan Heinrich  
Prof. Joachim Werther  
Prof. Maksym Dosta  
Dr.-Ing. Ernst-Ulrich Hartge

### From the Otto von Guericke University Magdeburg

Prof. Evangelos Tsotsas

### External speakers

Dr.-Ing. Michael Jacob, Glatt Ingenieurtechnik GmbH, Weimar  
Prof. Stefan Palzer, Nestec SA, Vevey, CH  
Prof. Mirko Peglow, IPT-PERGANDE GmbH, Weißandt-Gölzau  
Dr.-Ing. Claus Reimers, Aspen Technology Inc., USA



Response

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60486 Frankfurt am Main, Germany