

## **Masterclass I (16. September)**

### **Supercritical drying of aerogels**

**Prof. Pavel Gurikov, Dr. Raman Subrahmanyam  
Hamburg University of Technology**

The aim of this master class is to discuss supercritical drying techniques relevant to the production of aerogels. We will begin with a short introduction to the gelation and solvent exchange process and address the question how these first steps determine the choice of the drying technique. We continue with a detailed discussion of the golden standard of the aerogel drying – supercritical drying with carbon dioxide. Along with the thermodynamic and kinetic considerations, we will also focus on the practical aspects of supercritical drying. Lastly, we will discuss recent developments in the field towards aerogel commercialization.

## **Masterclass II (17. September)**

### **Characterization of Aerogels - Properties, Prospects and Pitfalls of Methods**

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Aerogels are a class of materials with extraordinary properties, such as high, well tunable porosity and pore sizes on the macro- to nanoscale, making them attractive for many applications ranging from thermal insulation, energy storage, filtration, catalysis and many others to acoustic damping and lightweight construction.

What makes aerogels special in terms of properties also brings up challenges in their characterization, as they may not fulfill all boundary conditions that are a prerequisite for methods that are well established for characterization of other porous materials such as N<sub>2</sub>-adsorption. How can these problems be addressed in order to provide a reliable feedback for sol-gel synthesis? In addition, definitions of several quantities have to be questioned: For example, how is pore size defined for a material which is characterized by “pores” that are voids in between a 3D-interconnected backbone? What is the impact of a solid phase fraction (=1-porosity) on physical

properties when only a minor part of it is “fully” connected and thus affects electrical transport or mechanical behavior? What is tortuosity and why is it a crucial quantity for all transport properties in aerogels?

In this Masterclass, we address key quantities that characterize aerogels in general, discuss techniques for their characterization and point out related potential pitfalls and alternative characterization approaches in particular for determining structural, thermal and mechanical properties of aerogels.

### **Masterclass III (18.09.2020)**

#### **Modelling of Aerogels**

**Dr. Andrej Lebedev (Moscow University of Chemical Technology)**

Within the framework of the master class, the possibilities of modeling using CFD method will be considered. Demonstration of the supercritical drying process simulation will be performed. During the demonstration, the geometry of the device will be built, the computational mesh will be generated, the model will be tuned and the computational experiment will be carried out.

For successful simulation, each participant needs to download the ansys student version (<https://www.ansys.com/academic/free-student-products>)