



Contribution ID: 48

Type: **Poster**

3D-printed humidity chamber for neutron scattering on thin films

Wednesday, December 9, 2020 5:40 PM (20 minutes)

The investigation of thin soft matter films with neutrons allows a non-destructive probe with good scattering statistics. It is used in a broad field of scientific interest that studies structures and performance of various soft matter systems such as hydrogels or organic solar cells. However, soft matter samples are very sensitive to humidity and temperature and require well-defined ambient conditions. As such, specialized sample environments are needed which provide stable control over the thermodynamic parameters at the sample position. In the framework of the FlexiProb project, a quickly interchangeable sample environment for experiments at the European spallation source (ESS) is designed. We focus on the design and fabrication of a specialized sample environment for the investigation of thin film samples with grazing incidence small angle scattering (GISANS). Its core is a 3D-printed humidity chamber that offers the necessary control of thermodynamic parameters such as temperature and humidity. The spherical chamber design has well distributed fluidic channels inside its walls, which provide a stable and rapidly adjustable temperature. The control over the atmospheric composition around the sample is realized by a remote-controlled gas-flow array that mixes up to three different humidified or dry air streams. The novel chamber design provides a first step into 3D-printed sample environment for neutron instrumentation.

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Session Classification: Joint poster session of MLZ User Meeting and DN2020

Track Classification: UM: Neutron Methods