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3D printed humidity chamber for neutron scattering experiments

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The investigation of stimuli-responsive organic thin films, which are sensitive to changes in temperature, humidity or other conditions, requires defined environmental conditions at the sample position. Especially in combination with neutron scattering techniques, such as grazing incidence small angle neutron scattering (GISANS) or neutron reflectometry (NR), high requirements to the sample environment are existing. In the framework of the FlexiProb project, which plans a flexible and interchangeable sample environment system for various neutron experiments at the European spallation source (ESS), we designed a sample environment for neutron scattering experiments on thin films in varying environmental conditions. Its core is a 3D printed aluminum chamber connected to an external gas- and fluid-flow. The chamber is designed spherical to reduce internal condensation and to provide a uniform heat distribution around the sample. For that purpose, fluidic channels through the chamber walls and lid help to minimize heat gradients throughout the chamber. The gas-flow can be composed of up to three different gas streams, where each one can be controlled individually. This provides pure gas or solvent atmospheres, or enables mixtures of different gas composition to the desired specifications. The developed setup is planned to be used at other neutron instruments as well and was already successfully tested at the REFSANS instrument at the MLZ.

Primary author: WIDMANN, Tobias (TU München, Physik Department, LS Funktionelle Materialien)

Co-authors: KREUZER, Lucas (TU München, Physik Department, E13); MÜLLER-BUSCHBAUM, Peter (TU München, Physik-Department, LS Funktionelle Materialien)

Presenter: WIDMANN, Tobias (TU München, Physik Department, LS Funktionelle Materialien)

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