ISIS Humidity Cell (closed chamber) – Technical info

This is a prototype cell, closed chamber for temperature and humidity control, compatible with Small Angle Neutron Scattering (SANS) and Reflectometry beamlines at ISIS. In comparison with other humidity cells for neutrons, the differential is the flat sapphire window to facilitate the use with Time-of-Flight mode.

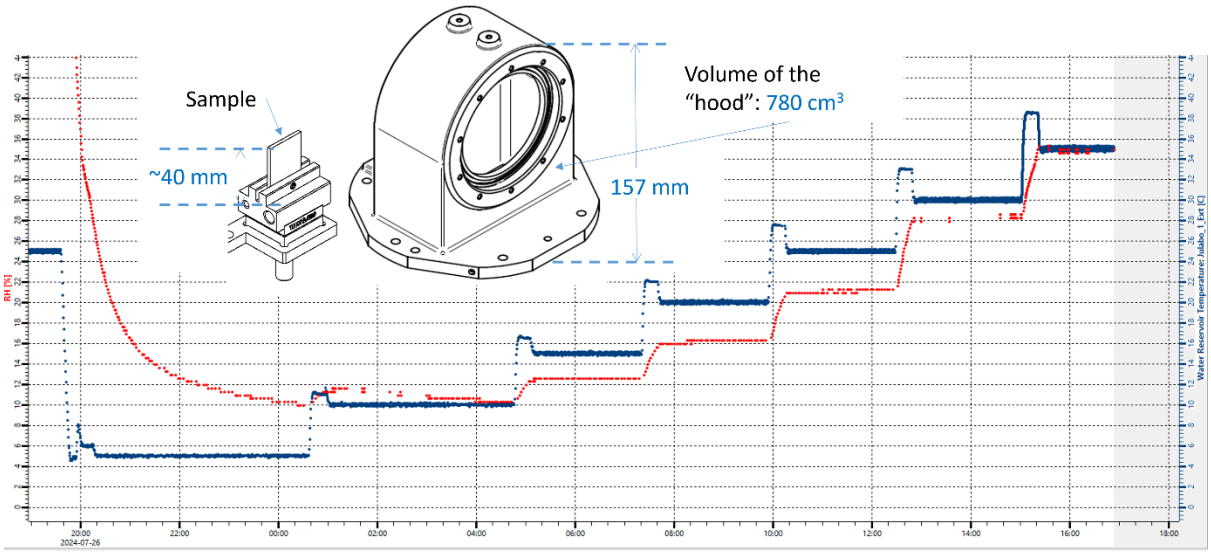

Figure 1: The sample holder can accommodate different sizes and shapes of samples. The typical samples are foams, free standing membranes or thin films built on Si wafer. We also tested powder in an open-top Quartz cuvette, which was feasible, but maybe not ideal to follow up the powder hydration homogeneously. The graph shows the relative humidity plateau (in red) reached through the method of overshooting of the temperature of the water reservoir (in blue) for a fixed temperature of the sample.

We have tested the limits of the cell in multiple aspects, which we summarise here: It can take from several minutes to few hours to get to a determined Relative Humidity (RH), depending on the requested temperature for the sample and how large the RH gaps are; We have tested the use of temperature overshooting to reach the plateau faster, as in the paper of Gonthier et al[1], and we have reached good stability by modulating the overshooting (Yi Zhang et al[2], not shown here, paper in preparation); We have observed that the sample hygroscopic characteristics can influence the map of temperatures and humidities, suggesting why it is important to test it offline prior to the neutron experiment; The offline test is essential near 100% RH, which is a delicate point to control internal condensation. This is still a prototype cell and there is room for improvement, mainly to get the cell more practical to use. For disambiguation, this is not a humid flow cell[3], but a closed chamber cell.

REFERENCES:

1. Julien Gonthier et al (**2019**) Journal of Neutron Research 21, 65–76
2. Yi Zhang, Leide P. Cavalcanti et al (**2025**) in preparation
3. Hiroshi Arima-Osonoi et al (**2023**) J. Applied Crystallography 56, 1802–1812

https://www.isis.stfc.ac.uk/Pages/TH_HumidityCell.aspx

27/6/2025