

In-Situ Pressure-Temperature Studies of Biological Systems Using Small-Angle Neutron Scattering Technique

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Scientific experiments that require the need to use extreme sample environments are ideally suited for neutron experiments due to the high penetration and non-destructive nature of neutrons. Among the many versions of pressure cells at Oak Ridge National Laboratory Neutron facilities, the Bio-SANS team has developed a pressure cell particularly to study biological systems that allows to heat samples up to 300 °C and hold pressures upto 1 kbar. The main motivation for this capability was to track, in real-time, chemical reactions that span multiple hours during deconstruction of the plant cell wall. This talk will present the technical developments addressed to achieve these capabilities and the class of science performed over the last decade on reaction studies of plant biosystems and plant biopolymers. This will include dilute acid (acidic), sodium hydroxide (basic), co-solvents (acidic water/THF) as well as organic solvents (catalytic super-critical methanol) reactions required to breakdown plant biosystems. The presentation will cover new in-sights gained by these experiments that were not possible by the ex-situ based techniques highlighting the paradigm shift in the thinking of biotechnologists pursuing biomass deconstruction strategies for the production of bioenergy and bioproducts. Finally, I will also cover other biological and soft matter relevant pressure cell capabilities available to ORNL SANS suite of users to perform experiments such as reactions under super-critical CO₂ and active in-situ stirring for mass transfer-limited reactions.

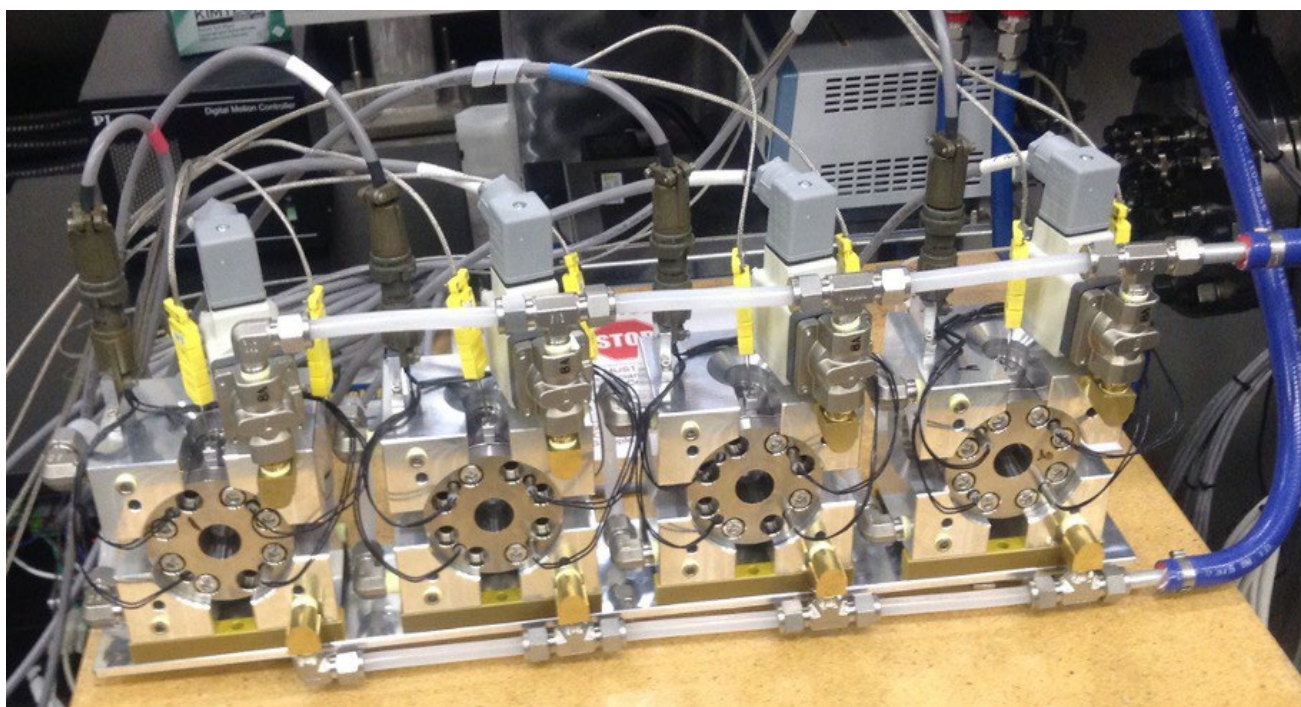


Figure 1