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Challenges of kinetic measurements with a Bonse-Hart neutron diffractometer

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Here we report on kinetic studies of the structural effects of applied shear on the gelation of silica using the Bonse-Hart type double crystal diffractometer (USANS) Kookaburra (ANSTO, Lucas Heights Australia). This instrument is able to cover a range of scattering vectors,  $2.8 \times 10^{-5} \text{ \AA}^{-1} < q < 4 \times 10^{-2} \text{ \AA}^{-1}$ . The gelation process may be viewed structurally as the aggregation of sol particles into larger fractal aggregates, which then form a percolative network (final gel). In previous SANS work, it was shown that shear interrupted the formation of the network, inducing a new, shear dependent structure where there are structural changes on the micron length scale. Here we use USANS to understand the structural pathway that the gel follows to the steady shear state. USANS measurements are made point by point with each rotation step of the analyzer crystal (rocking curve), with counting statistics aimed at resolving a signal above the background. To gather a comprehensive rocking curve, a single measurement will take of the order of hours, putting the ability to cover interesting kinetics beyond the realm of an ordinary beamtime allocation. Here, USANS measurements were made on the gelling system, where each measurement consists of a restricted number of points in the rocking curve, with points selected according to their ability to characterize the intermediate structure.