Utility of Absolute Calibration in SANS and SAXS Studies of Polymers and Colloids

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Absolute calibration forms a valuable diagnostic tool for the detection of artifacts in SANS and SAXS experiments. This lecture emphasizes the importance of placing data on an absolute scale, in units of cm^{-1} and reviews the methods available to accomplish this. In order to minimize the time associated with calibration, emphasis is placed on the development of strongly scattering standards which may be run in brief time periods, and special attention is paid to those that can be used for both neutron or X-ray experiments. Independent calibrations of such standards may be tested by comparison with the theoretical relationship between the x-ray and neutron cross sections.

The use of absolute units is not essential for measuring the spatial dimensions, though the cross section is a sensitive indicator of whether an appropriate structural model has been chosen. Thus, scattering from colloidal micellar solutions may be modeled by core-shell structures as a function of a set of parameters such as the inner/outer radius etc. On an arbitrary scale, it is possible to produce excellent fits of the *shape* of the scattering, which may be in error by *orders of magnitude* in intensity. Absolute calibration allows such artifacts to be recognized, and to restrict the model parameters to those which reproduce the observed cross section. Conversely, even an approximate (± 25%) calibration is sufficient to confirm the assumptions of the structural model chosen. The utility of absolute calibration in small angle scattering will be illustrated by examples comparing model calculations and experimental data from a range of polymeric and colloidal systems.

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