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Transmission Analysis in Time-of-Flight Small-Angle Neutron Scattering

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Transmission of materials includes a lot of information as can be seen in X-ray and UV-Vis absorption spectroscopies. It is useful especially for hard matter, which includes a variety of elements compared with soft matter. In small-angle scattering experiments, since the transmission is always measured at the same time as scattering, combined use of the transmission and scattering will provide new insight into the materials.

Furthermore, new generation pulsed neutron sources open a new era. Since a time-of-flight (TOF) technique is generally used at the pulsed neutron sources, they can simultaneously provide neutron transmission spectra as well as scattering profiles. This means that the TOF small-angle neutron scattering (TOF-SANS) simultaneously enables not only a SANS analysis but also a neutron transmission spectroscopy. In this study, we propose the combined use of the SANS and transmission analysis in TOF-measurement, which gives us new insight of the materials.

The analysis techniques of the neutron transmission spectra have greatly progressed in recent years with the development of a pulsed neutron imaging [1]. One of the most successful techniques is a Bragg-edge transmission analysis. It is useful to obtain crystallographic information, which can not be given by SANS [2]. In addition, a depolarization analysis, would be useful for magnetic materials [3,4]. Using a polarizer, a spin flipper, and an analyzer (the so-called POLARIS setup), a polarization spectrum can be observed without additional equipment.

Several preliminary experiments for the simultaneous analysis of the SANS and Bragg-edge have been performed. For the SANS and depolarization analysis, technical practicability and possible application are discussed.

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