

# New Options for Time-of-flight Reflectometry at AMOR

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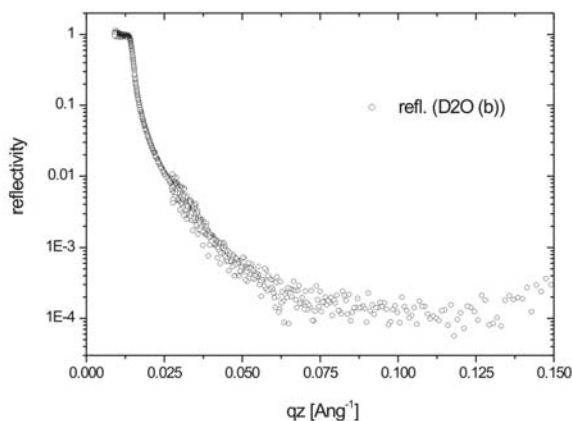
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*Measurements in time-of-flight mode with a single detector set-up are feasible now at the reflectometer AMOR. Specular and off-specular reflectivity of polymer multilayered systems have been measured using this set-up. In addition the possibility to measure reflectivity at the air-liquid water interface has been tested successfully. Magnetic fields up to 1.5 T at temperatures between 4 K and 300 K are available on installation of electro- or cryomagnets at the instrument. Remanent FeCoV/Ti:N supermirrors are installed as polarizer and analyzer at the instrument to allow full polarization analysis in future work.*

To exploit the advantages of time-of-flight neutron scattering for reflectometry the principal design of the reflectometer AMOR at SINQ was chosen to operate the instrument in time-of-flight mode in general [1,2]. With implementation of the necessary data acquisition system reflectivity measurements using a <sup>3</sup>He single detector set-up now are feasible at the instrument. Time-of-flight data are stored in NeXus data file format HDF5 [3]. In a first series of user experiments specular and off-specular reflectivity of different polymer layer systems has been measured in time-of-flight mode (I/01 L-12, I/02 S-52, II/02 S-27) demonstrating the capabilities of the installed set-up. The reflectivity of the polymer layer on a solid Si-support was detected at various regions of  $q_z$  by tilting the sample towards the incoming beam.

To perform reflectivity measurements in time-of-flight mode from liquid interfaces another set-up has been tested successfully at AMOR. The horizontal sample interface is fixed and the incoming beam is tilted towards the interface by a reflecting supermirror. In this geometry a maximum  $q_z = 0.15 \text{ \AA}^{-1}$  could be reached for an air-liquid D<sub>2</sub>O interface (Fig. 1) in a Langmuir trough. The trough used for these measurements belongs to the neutron reflectometer V6 at BENSC, HMI.

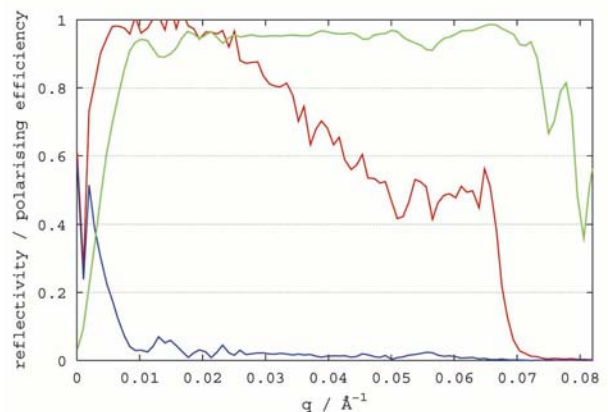
The time-of-flight mode allows the usage of large sample equipment at the instrument. For studying magnetic behaviour an electromagnet with up to 1.5 T horizontal field at room temperature or a cryomagnet with 1.5 T horizontal field at temperatures between 4 K and 300 K can be installed



**Figure 1:** Reflectivity of liquid D<sub>2</sub>O at room temperature.

and were used at AMOR recently (I/02 S-53, I/02 S-45, II/02 S-43, II/02 S-37). The electromagnet belongs to the SANS-I instrument at SINQ.

To perform reflectivity measurements with polarized neutrons at AMOR remanent FeCoV/Ti:N supermirrors have been installed as polarizer and analyzer [1,2]. The used supermirrors were tested at TOPSI. They offer a polarization efficiency of 95 % and more (Fig. 2). After installation of necessary guide fields to suppress current losses in neutron polarization along the beam path full polarization analysis will be applicable. Operation of the 2D PSD within the next allocation period will lead to further improvements in the options for time-of-flight reflectometry at AMOR.



**Figure 2:** Reflectivity and resulting polarization of polarizer/analyzer supermirror installed at AMOR as measured at TOPSI.

- [1] D. Clemens, Physica B **221**, 507 (1996).
- [2] D. Clemens, P. Gross, P. Keller, N. Schlumpf and M. Könnecke, Physica B **276-278**, 140 (2000).
- [3] U. Filges and M. Könnecke, PSI Scientific Report 2001, Vol. II, 115 (2002).

Instruments: AMOR, TOPSI, SANS-I  
Work fully performed at SINQ