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Uncover processes at the interface with neutrons

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The method grazing incidence small angle neutron scattering (GISANS) is about having a break-through, but one essential step needs to be taken: We need a dedicated GISANS instrument at the MLZ that allows to monitor processes.

Neutrons have utmost advantages over x-rays: We can monitor processes at the solid-liquid interface that is nearly impossible for x-rays. In many applications we need to follow structural changes during the operation of the solid-liquid interfaces such as in batteries, in fuel cells, and in catalytic reactions. Therefore, we need a dedicated instrument that focuses on the Q-range of interest, and monitors the process in shortest time-slices. This needs a new dedicated GISANS instrument that is not available anywhere in the world.

From existing instruments (REFSANS, MARIA, and KWS1), which are less optimized for GISANS measurements, we can guess that shortest time-slices of 10 to 30 minutes are possible, if all parameters of the new instrument are optimized. This would bring new quality to surface science, which so far was dominated by the x-ray community.

Other hot topics where neutrons introduce a new or varying contrast are (a) organic and hybrid solar cells, (b) the deposition process of films and coatings, and (c) magnetic and non-magnetic particles. In combinations with x-rays, new multicomponent structures can be resolved in more detail, and specific roles of particular components discovered.

It is a strategy of the new GISANS instrument at the MLZ to make use of synergies with other instruments at the ESS, at DESY and the ALS to proceed even faster with software development, data analysis, and scientific output. The experts of the instruments and the exchanging user community will maximize the output of the linked instrument suite.

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