ESRF	**Experiment title:** Structure of the Pb(liq.)-Si(hkl) solid-liquid interface (Block allocation of beamtime with MI-339)	**Experiment number**: SI-504
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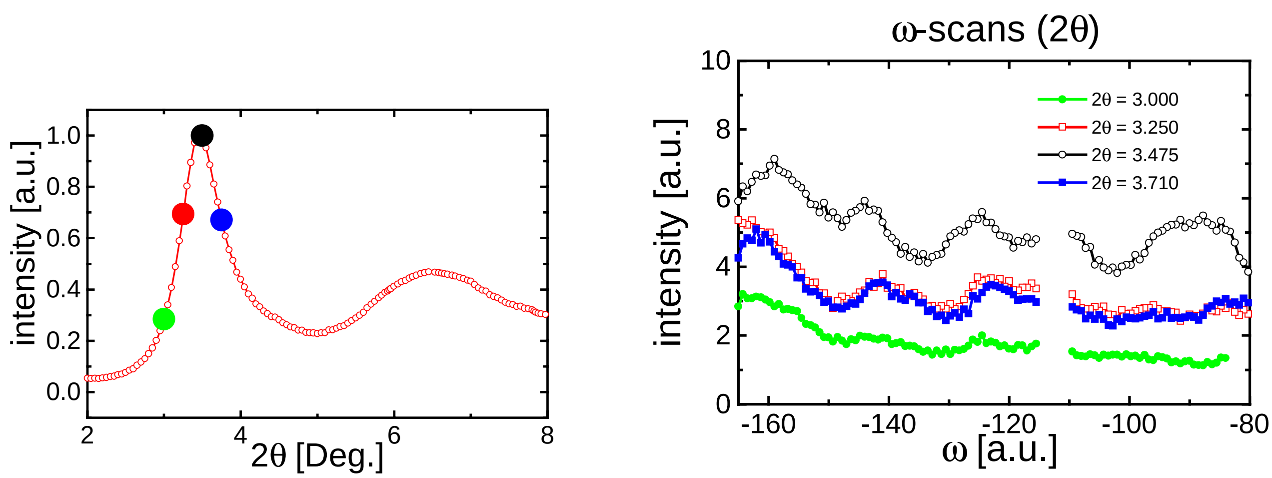
Report:

It is expected that the local structure of a liquid in contact with a solid is crucially altered. Modern theories predict a layering perpendicular to the interface within a width given by the correlation length of the liquid [1-3]. Recent x-ray reflectivity measurements at a diamond (111)- Ga(liq.) interface have demonstrated strong evidence for a pronounced layering in the liquid density which decays exponentially with increasing distance from the interface [4]. The modified liquid layer is expected to show an in-plane modulation induced by the periodic potential of the solid substrate. This leads to several interface related x-ray scattering signals, which may be subdivided [5] into (i) a contribution of the liquid structure factor to the inplane Bragg peaks of the solid, (ii) a replication of the liquid scattering around the reciprocal lattice points of the crystal structure, and (iii) an anisotropic in-plane modulation of the (normally isotropic) structure factor of the liquid. We have investigated the inplane structure of the model hard sphere fluid Pb in contact with clean and single crytsalline Si(001). In particular, we have supplied first experimental data for a test of claim (iii) in the above list.

We have used a high energy beam with E=71.5keV in order to penetrate a thick Si(001) cylinder. The beam was impinging onto the Pb(liq.)-Si(100) interface at an angle of α_i=0.02°, while the critical angle for total internal reflection is α_c=0.041° under the experimental conditions. This has produced an evanescent wave within the liquid side of the interface, which is subject to scattering at the density inhomogenities of the liquid. The in-plane liquid structure factor S_{liq} has then been probed by moving a Ge solid state detector out of the plane of incidence while keeping the exit angle α_f of the scattered beam close to or below the critical angle α_C. The scattered intensity has then been recorded in the plane of the interface using a Ge solid state detector. In order to separate the interfacial part of the liquid structure factor from bulk scattering contributions from both the solid and the liquid we have established a vertical beam height of 10μm which is the projected height of the interface in the beam. Horizontally we have accepted 1.5 mm of the incident beam. The solid-liquid interface has been prepared in-situ in a mobile UHV-chamber. In this chamber we can clean the two surfaces separately prior to contacting the surfaces. For a critical test of claim (iii) we have have measured the azimuthal distribution of the liquid-structure factor for several |q|-values at and around the first maximum of the bulk liquid structure factor (marked in the measured bulk liquid structure factor in the left figure below). While the position of the first maximum of the interfacial liquid structure factor is the same as for the bulk, the measurements show for the first time an anisotropic intensity distribution in the first liquid structure factor maximum along the azimuth ω (with respect to the Si-substrate).



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