ESRF	**Experiment title:** The hydrophobic gap in contact with nonpolar solvents	**Experiment number**: SC 4245
Beamline: ID 31	**Date of experiment**: from: 29.4.2016 to: 02.5.2016	**Date of report**:
Shifts: 9	**Local contact(s)**: Veijo Honkimäki, Jakub Drnec	*Received at ESRF:*

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Report:

We investigated interfaces between hydrophobic, octadecyltrichlorosilane (OTS) coated silicon wafers and different polar and non-polar solvents. The structure of hydrophobic fluorocarbon/water interfaces is discussed in literature for many years ([1]-[6]) giving the result that an electron depletion area, the so-called hydrophobic gap, exists between the OTS tail groups and the water phase. The origin is most likely a reorientation of the water molecules, leading to lower densities at the solid-water interface. The lower electron density of the OTS CH_3 end-groups contributes also to the observed gap. By using solvents of different polarity, we want to obtain more information on the surface properties and with this on the origin of the hydrophobic gap.

Our measurements were performed at ID 31 with a photon energy of 70 keV and a beam size of 5x40 µm² (v x h). The high beam energy was essential for our experiment as we used solvents with a high electron density. The high energy made it also possible to reach large q_z values up to 0.8 $Å^{-1}$, which are necessary for obtaining high-resolution density profiles of the interface.

We were able to measure different mixture ratios of chloroform and methyl tert-butyl ether (MTBE) and of p-xylole and trichlorbenzole. Mixing these solvents helped to tune the electron density contrast between the solvent and the OTS. All these measurements were first performed with only one solvent as sample liquid. After test measurements for determining beam damage, 1 ml of the other part of the mixture was added, resulting in a different electron density of the liquid. This procedure was repeated twice for each combination. In figure 1, electron density profiles and measurements for such a series are shown. Starting with 100% MTBE as liquid phase (blue solid line), a small dip in electron density on top of the OTS is visible. When the electron density increases because of a higher amount of chloroform added to the solution, this dip vanishes. Also, measurements with acetone, ethylene glycol, n-hexane and methanol could be performed. The data analysis is still in progress.

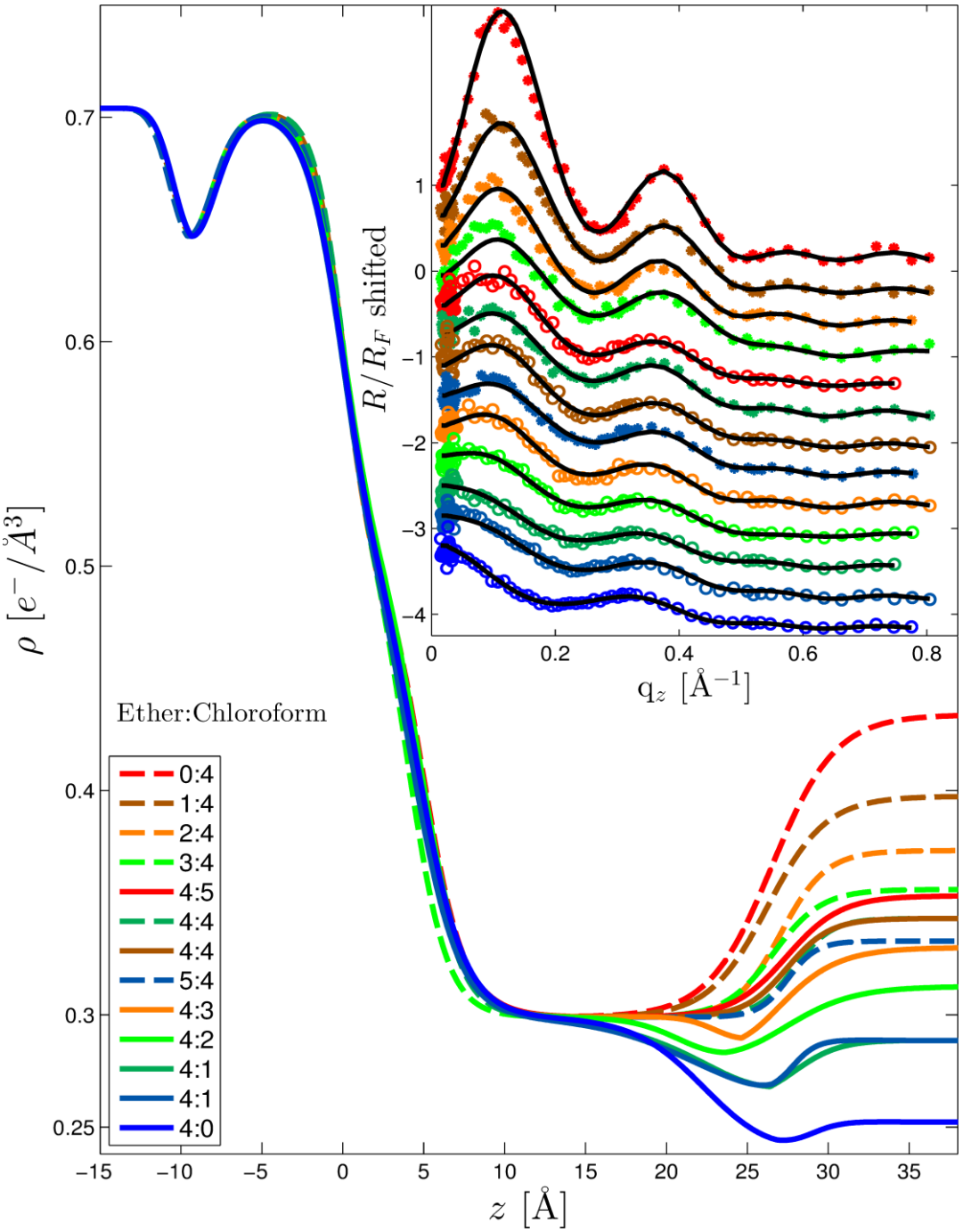

Figure 1: Measurements of different ratios of chloroform and MTBE on an OTS coated silicon wafer. Measurements of two different samples are shown, one starting with MTBE (solid lines in electron density profiles, circles in the inset) and successive addition of chloroform, the other one starting with chloroform (dashed line, stars in the inset) and successive addition of MTBE.

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References

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