

O 27: Poster Session II: Poster to Mini-Symposium: Molecular scale investigations of liquid-vapor interfaces I

Time: Monday 13:30–15:30

Location: P

O 27.1 Mon 13:30 P

Temperature-dependent trapping probability measurements of *n*-butane on ionic liquid surfaces using molecular beam techniques — ●LEONHARD WINTER, RADHA G. BHUIN, MATTHIAS LEXOW, FLORIAN MAIER, and HANS-PETER STEINRÜCK — Lehrstuhl für Physikalische Chemie II, Friedrich-Alexander-Universität Erlangen-Nürnberg, Egerlandstr. 3, 91058 Erlangen

Ionic Liquids (ILs) are room temperature liquids consisting only of cations and anions. IL thin films are the key components in the catalytic concepts Supported Ionic Liquid Phase (SILP) and Solid Catalyst with Ionic Liquid Layer (SCILL), for which the transfer of hydrocarbons through the ionic liquid/gas interface plays a crucial role.

We have built a new ultra-high vacuum apparatus dedicated for the investigations of ILs with molecular beam techniques. It was used to study the first step of the interaction dynamics of *n*-butane on a series of alkylimidazolium ionic liquids with varying chain lengths and anions ($[C_nC_1Im][X]$). Based on the temperature-dependent behavior of the initial trapping probability at low temperatures, measured by the direct method of King and Wells, we found that the binding energy is dominated by the interaction with the alkyl chain of the cation, whereas the ionic headgroups contribute only weakly.

L.W., R.G.B, M.L. and H.-P.S. thank the European Research Council (ERC) for financial support of this research in the context of an Advanced Investigator Grant to H.-P.S (No. 693398-ILID).

Bhuin *et al.*, *Angew. Chem. Int. Ed.*, **2020**, 59, 14429-14433.

Winter *et al.*, *J. Chem. Phys.*, **2020**, 153, 214706.

O 27.2 Mon 13:30 P

Surface tension measurement of pure water in vacuum. — ●JIRI PAVELEC, PAUL RYAN, JAN BALAJKA, MICHAEL SCHMID, and ULRIKE DIEBOLD — IAP, Vienna University of Technology, Austria

Very little is known about the surface tension of pure liquids in contact with their pure gaseous phases, i.e. without the presence of other gases or liquid phase contaminants. This is surprising given that contaminants are known to greatly affect surface tension values [1].

Recently we have developed a method to dose liquid water onto pristine surfaces in UHV using a small cryostat [2,3]. We combine this approach with the pendant drop method [4] to measure the surface tension of ultra-clean liquids in contact with their pure gaseous phases. The upgraded version of the small cryostat, replaces the syringe typically used in the pendant-drop method. The ultra-clean liquid is condensed onto a small cryostat placed in a vacuum chamber. A pendant drop is formed, photographed and analyzed allowing the surface tension of the liquid to be directly determined.

The design of the apparatus will be discussed and preliminary measurements of ultra-clean water will be presented.

[1] Uematsu, Bonthuis, Netz, *Current Opinion in El.*, Vol. 13, (2019)

[2] Balajka, Pavelec, Komora, Schmid, and Diebold, *Review of Scientific Instruments* 89, (2018)

[3] Balajka, Hines, DeBenedetti, Komora, Pavelec, M Schmid, U Diebold, *Science*, 361, (2018)

[4] Berry, Neeson, Dagastine, Chan, Tabor, *J. Coll. Interface Sci.* 454, 226, (2015)

O 27.3 Mon 13:30 P

pH-dependence of the surface enrichment of inorganic ions mediated by amino acids — ●ISAAC UNGER¹, GEETHANJALI GOPAKUMAR¹, OLLE BJÖRNEHOLM¹, CARL CALEMAN^{1,6}, CHRISTOPHE NICOLAS², GUNNAR ÖHRWALL³, TULIO COSTA RIZUTI DA ROCHA⁴, and ARNALDO NAVES DE BRITO⁵ — ¹Uppsala university — ²Synchrotron SOLEIL — ³MAX IV Laboratory — ⁴Brazilian Synchrotron Light Laboratory — ⁵University of Campinas — ⁶Center for Free-Electron Laser Science, DESY

Sea spray is one of the most prominent sources for non-anthropogenic aerosol, thus understanding sea spray aerosol plays a pivotal role in understanding the Earth's atmosphere. Aqueous sea spray aerosol is a complex mixture of organic surfactants and inorganic ions and is also the subject to changes over time as the particles are suspended in the atmosphere and engage in chemical reactions. One of the dynamic parameters in the particles is the pH, as sea spray aerosol is generated from slightly basic sea water but quickly assumes acidic pH. How changes in the pH affect the surface composition of such particles has only recently become the subject for in-depth research. Our results attempt to fill the knowledge gap by investigating the pH-dependent surface propensity of K^+ and Cl^- in a mixed KCl-amino acid solution. We used X-ray photoelectron spectroscopy on liquid jets to explore the impact of a variety of amino acids with different side chains on the ratio of K^+ and Cl^- close to the liquid surface.

O 27.4 Mon 13:30 P

Probing the Gold/Water Interface with Surface Specific Spectroscopy — ●STEFAN PIONTEK, STEPHANIE SANDERS, DENNIS NAUJOKS, ALFRED LUDWIG, and POUL PETERSEN — Ruhr Universität, Bochum, DE

Water is integral in electrochemistry, in the generation of the electric double layer, and propagating the interfacial electric fields; yet our molecular-level understanding of interfacial water near functioning electrode surfaces is limited.

Sum-frequency-generation (SFG) spectroscopy offers an opportunity to investigate the structure and dynamics of the solvent near working electrochemical interfaces, as the method is inherently surface-specific. Previous attempts which propagated IR beams through the solvent have suffered due to the IR absorption of water. Furthermore, sending visible and IR beams through standard electrode films obscures the SFG spectra, due to the large nonlinear response of conduction band electrons.

To overcome this limitation, we have investigated thin yet conductive gradient sputtered Au films on CaF₂ using SFG, FTIR, AFM, and UV-Vis spectroscopies to explore the ideal thickness of an Au electrode layer. SFG spectra of dry and wet 8.0-0.4 nm thick Au films suggest that unobscured interfacial water spectra can be obtained using Au films with a thickness of ~2 nm or less. With the newfound ability to probe interfacial solvent structure at electrode/aqueous interfaces we hope to provide insights into more efficient electrolyte composition and electrode design.