CPP 38: Interfaces and Thin Films II

Time: Thursday 16:15–17:45 Location: H38

Invited Talk CPP 38.1 Thu 16:15 H38

Adsorption and Interaction of Amino Acids on Titanium Oxide Photocatalyst — Miguel Blanco-Garcia[1], Mona Kohantorabi[1], Benedikt Socher[2], Ulrike Protzer[3], Stephan V. Roth[2], Cristiana Di Valentin[4], Andreas Stierle[1], and •Heshmat Noei[1] — [1]Centre for X-ray and Nano Science CXNS, Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany — [3]Institute of Virology, Technical University of Munich/Helmholtz Munich, 81675 Munich, Germany — [4]Department of Materials Science, University of Milano-Bicocca, Via R. Cozzi 55, I-20125, Milano, Italy

We investigated the adsorption behavior of amino acids and SARS-CoV-2 virus on rutile (110) and anatase (101) TiO2 surfaces through a combined experimental and theoretical approach and explored the molecular configurations and bonding mechanisms involved in interaction of cysteine and SARS-CoV-2 with TiO2. Clarification of the interaction of the virus with the surface of semiconducting oxides will aid in obtaining a deeper understanding of the chemical processes involved in photo-inactivation of microorganisms which is important for developing advanced photocatalytic materials for environmental and biomedical applications. [1] M. Kohantorabi, et al., ACS Appl. Mater. Interfaces 16, 28 (2024) 37275. [2] M. Kohantorabi, et al., ACS Appl. Mater. Interfaces 15, 6 (2023) 8770.

CPP 38.2 Thu 16:45 H38

PNIPAM Microgel-Stabilized Foam Films: Effect of Crosslinker Content and Purification State — •Luca Mirau, Joanne Zimmer, Kevin Gräff, Matthias Kühnhammer, and Regine von Klitzing — Institute for Condensed Matter Physics, TU Darmstadt, Germany

Aqueous foams find widespread application in fields such as cosmetics, food industry, oil recovery and fire-fighting. Their stabilization requires the presence of surface-active molecules or colloidal particles. In this study, thermoresponsive microgels (MGs) composed of poly(N-isopropylacrylamide) (PNIPAM) with varying crosslinker contents are applied as foam stabilizers, resulting in temperature-sensitive foams. Foam films serve as the fundamental building blocks of foams. The structuring of MGs within these films is analyzed using the Thin Film Pressure Balance (TFPB) technique. Foam films are formed within a pressure chamber, and their thickness is determined through interferometric methods under a light microscope. The foam films display an inhomogeneous structure comprising significant pattern formation, i.e. a network-like, several 100nm thick region containing MGs, interspersed with thin MG-depleted zones less than 100nm thick. The findings indicate that the crosslinking content plays a crucial role in MG layering within these thick network regions, influencing the film thickness. Additionally, the purification state of the MGs, monitored through interfacial tension measurements, governs the formation of thin zones in the foam films, which strongly affects their stability.

CPP 38.3 Thu 17:00 H38

Ion Specific Effects and Photo-Switching of Surfactants at Interfaces — •Dana Glikman and Björn Braunschweig — Institute of Physical Chemistry and Center for Soft Nanoscience, University of Münster, Busso-Peus-Str. 10, 48149 Münster (Germany)

Understanding surface charging and molecular structure changes at oil/water (O/W) interfaces in nanoemulsions is critical for enhancing colloidal properties. In previous work, we demonstrated that photoswitchable surfactants could modulate interfacial behavior. Specifically, we studied an arylazopyrazole (AAP) derivative that undergoes photoisomerization between E and less surface-active Z isomers. In nanoemulsions with droplets showing an average radius of 90 nm, no significant changes in drop size or ζ-potential were observed upon E/Z photo-isomerization. However, second-harmonic scattering (SHS) revealed substantial changes in surfactant coverage which were attributed to ion condensation at the interface [1]. In this contribution, we now focus on the role of specific ion effects and the structural influence of the surfactants' head group. By systematically varying between Li, Na, and Cs cations and by using surfactants with different head group architectures, we aim to dissect the interplay between ionic specificity and head group structure. To study the adsorption of the surfactants at the interface, we are analyzing SHS profiles combined with measurements of the ζ-potential at the shear plane, in order to reveal a detailed mechanisms of ion-specific effects and ion condensation in these nanoemulsions. [1] Glikman et al. J. Am. Chem. Soc. 146, 8362 (2024).

CPP 38.4 Thu 17:15 H38

Anomalous Screening Behavior of Superchaotropic Ions — •Thomas Tilger, Esther Ohnesorge, Michalis Tsintsaris, and Regine von Klitzing — Department of Physics, Technische Universität Darmstadt, Darmstadt, 64289, Germany

Due to their special properties, which make them suitable for many applications such as wastewater treatment, separation of nuclear waste and the stabilization of foams, the interest in superchaotropic nano ions grew during the last years. Especially for the last application, it is crucial to understand how the presence of these ions modifies the interaction between interfaces.

To directly measure the forces between well-defined interfaces, colloidal probe atomic force microscopy (CP-AFM) has proven to be a powerful tool. As model system for nano ions we chose Keggin ions as well as dodecaborate clusters and investigated their influence on the interaction between colloidal silica beads in aqueous solutions.

It turned out that - despite the large ion size of up to one nanometer - the interaction between the silica beads can still be described by the classical DLVO-theory of electrolyte solutions, consisting of a van der Waals attraction and an electrostatic double layer repulsion. However, the obtained screening lengths exhibit a significant deviation from the ones expected according to the nominal ionic strength of the solutions. This might be a hint for an ion aggregation. The magnitude of the deviation depends on the type of nano ion as well as the concentration of the solution.

CPP 38.5 Thu 17:30 H38

The Physics of Water-based Inkjet Printing: Fundamentals in a Nutshell — Helder Savaldor[1,2] and •Nicolae Tomozeiu[1,2] — [1]Canon Production Printing, P.O Box 101, Van der Grintenstraat 1, 5914HH Venlo, The Netherlands — [2]Fluids & Flows Group, Department of Applied Physics, Eindhoven University of Technology, The Netherlands

The printing industry is rapidly evolving, driven by advances in understanding physical-chemical processes and societal needs. Digital inkjet printing, especially with water-based inks, has become a cornerstone of sustainable and cost-effective printing, with Canon Production Printing (CPP) leading innovations in this field. The interaction between ink droplets and porous paper is crucial to achieving high-quality prints, and understanding these processes is essential for improving print performance and durability.

This work explores key scientific domains involved in CPP water-based inkjet technology. We focus on: (i) ink formulation through chemical and polymer physics for optimal droplet formation and film creation; (ii) the dynamics of thin films, including ink spreading, evaporation, and imbibition in porous paper; (iii) surface science's role in ink absorption and spreading. We will show the use of Optical Spectroscopy, Scanning Electron Microscopy (SEM), Nuclear Magnetic Resonance (NMR) and uGISAXS to provide deeper insights into ink film formation at the micro- and nano-level. These findings optimize print quality, durability, and color properties, advancing both industrial development and academic knowledge in inkjet technology.