O 77: Poster Vacuum Science Technology: Theory and Applications

Time: Wednesday 18:00–20:00 Location: P2

O 77.1 Wed 18:00 P2

An apparatus of preparing frozen solution samples for ultra-high vacuum experiments — •Jiadong Guo, Xinmeng Liu, and Ying Jiang — International Center for Quantum Materials, School of Physics, Peking University, Beijing, China

Here we develop an apparatus for preparing frozen solution samples, which can be characterized by surface science techniques under ultra-high vacuum (UHV) condition. When a temperature-variable substrate is approached to contact the frozen solution at 77 K, the surface of the frozen solution is locally melted and then refreeze with the substrate. By detaching the substrate from the frozen solution in high vacuum, the frozen solution is cleaved and transferred onto the substrate. Applying this method, we demonstrate transferring NaCl and $LiNO_3$ frozen solutions onto the Au substrate, and directly image the crystallization of NaCl and $LiNO_3$ using atomically resolved atomic force microscopy (AFM) in UHV at 5 K.

This apparatus provides a new approach to transfer solution samples in their glassy states into the UHV environment while maintaining the cleanliness of the samples, laying the foundation for further research related to solution environment, such as crystallization, hydration, chemical reaction, materials synthesis and bioimaging.

O 77.2 Wed 18:00 P2

Investigating Nanoscale Hydrophobic Polymer Coatings for the use in the Einstein Telescope — •Maike Kühler, Achim Stahl, Charlotte Benning, and Oliver Pooth — III. Physikalisches Institut B, RWTH Aachen

With 120 km pipes of 1m diameter, the ultra-high vacuum (UHV) system of the Einstein Telescope is going to be one of the largest vacuum systems in existence. It will need an enormous input of innovation and optimization. This work explores superhydrophobic coatings for the vacuum chambers of the Einstein Telescope. Hoping to achieve faster pumpdown times and eventually lower bake out temperatures to reach sufficient pressure regimes. This poster presents a coating based on reactive silyl anchor units and functionalised with a long perfluoropolyether/organofluorine chain. The coating has been investigated for its performance and compatibility with UHV conditions. Its compatibility with the vacuum system of the Einstein Telescope was evaluated through molecular flow simulations.

O 77.3 Wed 18:00 P2

Tritium Induced Exchange Reaction of Hydrogen Isotopes — •James O'Callaghan, Robin Grössle, Simon Niemes, and Robin Holzwarth — Tritium Laboratory Karlsruhe (TLK), Institute of Astroparticle Physics (IAP), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Tritium (T), the heaviest isotope of hydrogen, is used for experiments in astro-particle physics and is essential as fuel for fusion reactors. It comes with many challenges due to its radioactivity. Isotopic exchange is one such challenge, Hydrogen-1 (H) and Deuterium (D) can be left in an idealised vessel and will practically not react with each other; the concentrations of H2, D2 and HD will remain unchanged and will not reach the thermal equilibrium in practical time scales. This is not the case with tritium. In the presence of tritium, the radioactive decay induces chemical reactions and therefore the concentrations will shift towards the chemical equilibrium. Most prominently in a fusion reactor context, starting with mixtures of homonuclear molecules (H2, D2, T2), the production of potentially undesirable heteronuclear molecules (HD, HT and DT) up to the chemical equilibrium is facilitated by the decay of tritium. This needs to be understood for designing fuel cycle components for a fusion reactor. In this contribution first efforts for a data driven development of an empirical model to describe the reactions rates in tritiated mixtures is given.