



Electron interactions with liquid micro-jets: Reactivity and Spectroscopy

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Electron-induced interactions in liquid-phase systems is a topic of considerable interest, impacting many fields such as fundamental research, radiation chemistry, semiconductor fabrication and materials science. Usually, such studies have been conducted in bulk liquids or thin films and were often encountering limitations related to electron scattering, charge recombination, and diffusion-controlled reactions [1].

In this work [2], we demonstrate a novel home-made experimental setup utilizing liquid micro-jet technique to investigate electron-induced processes. The novelty of the experiment lies in the ability to deliver a controlled liquid sample into a high-vacuum environment and irradiate it directly by focused electron beam with tunable energy of up to 1keV.

Reactivity. An important key feature of our experimental setup in Prague is recirculating micro-jet, allowing a solution with target molecules to be passed through vacuum while being exposed to an electron beam. After several passes, the sample is extracted and submitted to an off-line chemical spectroscopic analysis for probing and quantifying the induced reactivity. We demonstrate a few example systems where electron-induced reactivity had taken place, giving a proof of concept for electron driven experiments in liquid-phase.

Spectroscopy. A custom home-made electron gun system has been originally designed and coupled to a high-resolution hemispherical electron energy analyzer, utilizing liquid micro-jet system at PLEIADES beamline of Synchrotron SOLEIL near Paris. We performed an electron-induced energy loss spectroscopy (EELS) of H₂O obtained for both gas- and liquid-phase in a region of a few hundred eV incident electron energy. We discuss the experimental challenges and characteristics of preliminary results obtained for H₂O Figure 1, as well as several other molecular systems.

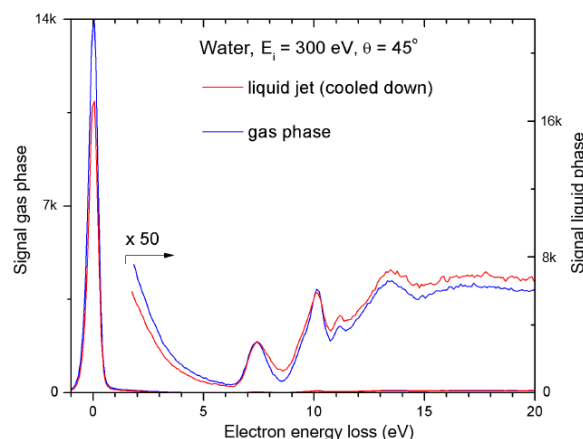


Figure 1 - EELS measured at 45° scattering angle and 300 eV incident electron energy.

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References

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