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Diagnostics of liquid-side phenomena in plasma-liquid interaction[1]

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We believe that the thin region (< 100 nm) just below the liquid surface is the key in plasma-liquid interaction. In this talk, we introduce our recent challenges to develop diagnostic methods for observing chemically active species in liquids interacting with plasmas. A research target was solvated electrons. We employed the CTTS (Charge Transfer to Solvent) transition of I^- to investigate the reactivity of solvated electrons. This is a kind of pulsed laser photolysis, and solvated electrons are produced by photodetachment of I^-. We observed the temporal decay of the solvated electron density by optical absorption spectroscopy. We examined the influence of the plasma irradiation on the reaction frequency of solvated electrons. We have found that solvated electrons have a higher reaction frequency in the region close (< 1 mm) to the plasma-liquid interface. However, unfortunately, the absorption spectroscopy combined with the CTTS transition was not applicable to the spatially resolved measurement at the interfacial region just below the liquid surface. Now we try the production of photoelectrons for the detection of solvated electrons at the interfacial region. The photoelectrons are produced by the desolvation. We have already detected the increase in the discharge current of an atmospheric-pressure dc glow discharge due to the production of photoelectrons. In addition, if the time is allowed, we will talk about the detection of luminol chemiluminescence and the measurement of the surface tension at the plasma-liquid interface. The luminol chemiluminescence was observed just below the plasma-liquid interface, and it may be useful for the detection of short-lived species such as OH. We have observed the enhancement of the surface tension of water by the irradiation of a plasma. The enhanced surface tension may be caused by the specialized chemical composition at the interfacial region just below the liquid surface.

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