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Correlation between OH density in gas and intensity of luminol chemiluminescence in liquid interacting with atmospheric-pressure DC glow discharge[1]

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The relationship between the density of OH radicals in the gas and the intensity of luminol chemiluminescence was investigated using an atmospheric-pressure plasma system in contact with liquid. The luminol chemiluminescence with a thin thickness was observed just below the plasma-liquid interface when the plasma was generated on the aqueous solution surface with luminol. The radial region with the chemiluminescence was approximately 2.6 times larger than that of the plasma with the optical emission, and was similar to the diameter of the region with OH radicals in the gas phase. The decay time constant of the intensity of the luminol chemiluminescence in the afterglow phase of the DC pulsed discharge was approximately 100 μs, while the optical emission intensity at the second positive system of molecular nitrogen decayed immediately after the termination of the discharge current. On the other hand, the decay time constant of the OH radical density was approximately 100 μs in the afterglow phase. In addition, we used other atmospheric pressure plasma source using helium crossed gas flow. We confirmed that OH radicals were transported to downstream of crossed gas flow. When this downstream region contacts with luminol, blue chemiluminescence is observed. These experimental results indicate that the luminol chemiluminescence is induced by the transport of OH radicals to the plasma-liquid interface.

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