Effect of Pulsed Voltage on Characteristics of Ionic Liquid Electrospray

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***Abstract*— The electrospray is a sophisticated technology to generate ultra-fine droplets by applying high voltage between a capillary nozzle and a counter electrode. Recently, electrospray using ionic liquid has been paid a special attention as an innovated ion source for space propulsion or mass spectrometry. Ionic liquid is an ambient temperature molten salt which is composed of only anion and cation and there are outstanding functionalities, e.g. low vapor pressure, high conductivity and high polarity. With ionic liquid electrospray, multivalent charged droplets and polyatomic ions are generated in a focused beam with a large ion mas. However, the electrospray with the high conductivity and viscosity liquid like ionic liquid has not been analyzed in detail yet.**

In this study, the characteristics of the electrospray with 1-Ethyl-3-methylimidazolium ethyl sulfate (C8H16N2O4S) as ionic liquid have been analyzed by measuring the ejected droplets size distribution and spray current under the atmospheric pressure for DC or positive DC pulse with duty ratio of 50 %. It was found that when positive DC pulsed voltage is applied to the nozzle, Taylor cone vibrates axially at the same frequency with the voltage frequency. The number of ejected droplets increases drastically with improved spray convergence compared to the case for DC applied voltage. The developed fluid dynamical model predicted that the optimum voltage frequency is strongly dependent on the vibration frequency of the ionic liquid meniscus and higher number of droplets can be generated by adjusting the voltage frequency with natural frequency of the liquid.