Open Channel Electrospray System

Joon Sang Kang, Jae Hee Jung and Gwi- Nam Bae

Center for Environment, Health and Welfare Research, Korea Institute of Science and Technology (KIST),
Hwarang-ro 14-gil 5 Seongbuk-gu, Seoul, Republic of Korea

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Presenting author email:022698@kist.re.kr

Although there are a lot of positive characteristics of the electrospray system, the system is restricted in many area because of the low flow rate. The electrospray system is related to the scaling laws relating the diameter of the electrosprayed droplet, d, and the flow rate, Q. With $d \sim Q^{1/3}$ or $d \sim Q^{1/2}$, the flow rate becomes very low for smaller droplets (Ganan-Galvo *et al.*, 1997; Fernandez de la Mora & Locertales, 1993). Therefore, increasing the droplet productivity at the micro/nano droplet level is difficult.

In order to overcome this drawback, we employed new electrospray nozzle that has multiple holes arrayed on the side of the nozzle. In particular, the working fluid was divided among the holes and ran along an open channel on the outer wall of the nozzle. From the nozzle configuration, we achieved the desired monodispersity of the generated droplets and positional stability

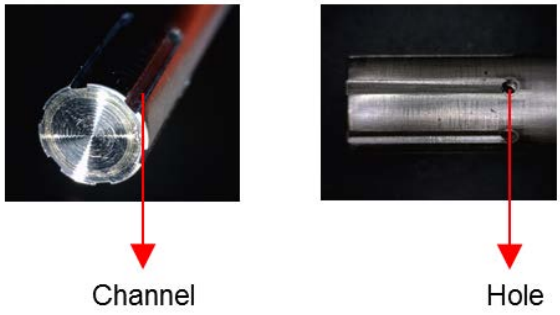

Figure 1. Pictures of nozzle

Figure 1 shows the pictures of nozzle in the present study. The primary difference of the nozzle in the present study compared to a conventional nozzle was that the nozzle exit was welded shut, and the working fluid was emitted through multiple holes arrayed on the side of the nozzle. The nozzle was made by stainless steel, and the outer diameter of the nozzle was 6.4 mm. Six holes (0.8 mm diameter) were evenly spaced on the side of the nozzle. To eliminate the positional instability of the multi-jet mode, an open channel was introduced from each hole to the tip of the nozzle.

Figure 2 (a) and (b) show that the difference in multi-jet formation depending on various experimental conditions, which demonstrate that an increased electric potential led to a much shorter liquid meniscus and that each jet was focused toward the open channel, as clearly shown in the Fig. 2 (c) and (d). Previous study reported that the number of jets rose with increasing electrical potential in the multi-jet mode (Duby *et al.*, 2006). However, in the present nozzle system, the number of jets was increased up to a maximum of 18 jets with increasing electric potential, but further increases in the electric potential decreased the number of jets down to 12.

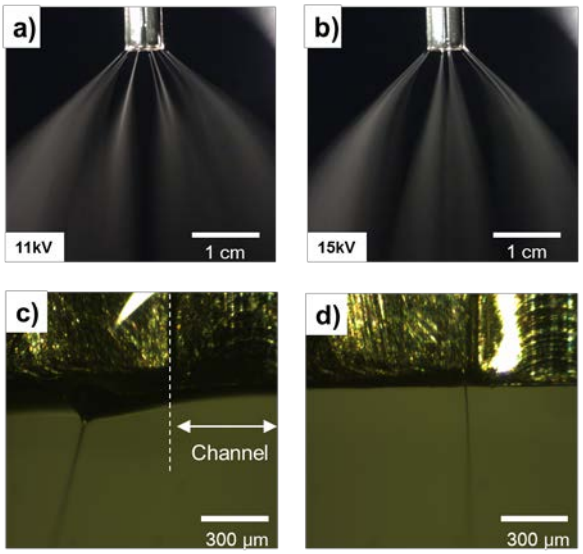

Figure 2. Picture of the various operational modes of the electrospray, with magnified views (Q = 60 ml/h)

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