ISFV15-063-S4

15th International Symposium on Flow Visualization
June 25-28, 2012, Minsk, Belarus

DEVELOPMENT OF INKJET NOZZLE DRIVEN BY DOUBLE PIEZO ACTUATORS

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KEYWORDS:
Main subjects: liquid droplets breakup, flow visualization
Fluid: micro-fluidics
Visualization method(s): microscope image processing
Other keywords: double piezoelectric actuation, droplet, inkjet nozzle

ABSTRACT: Patterning of conductive materials from suspensions becomes now a significant technology in the electronic packaging because it can reduce a total number of processes by direct writing technology using an inkjet nozzle. In this study, an inkjet nozzle driven by multiple piezoelectric actuations is developed in order to dispense conductive ink. The body of the nozzle which is fabricated by precision machining techniques is made from transparent acrylic material to visualize the flow inside the nozzle. Then, tantalum foil covers top of the channel formed in the nozzle body. On the top of the tantalum foil, two piezoelectric actuators are attached. The piezoelectric actuators are activated by a voltage amplifier which generates high-voltage square waves. Droplet formation through the nozzle is monitored by a CCD camera and a microscope objective. The key idea of the present nozzle is a successive actuation of multiple piezoelectric actuators, which makes the ejection and suction of liquid more controllable than the single piezoelectric actuator. The main control parameter is the time separation of the pulses fed into the two piezoelectric actuators. Besides, different voltage and pulse width in the square waves are applied to each actuator. In the present study, the speed and size of the droplets was measured. Furthermore, pressure behavior inside the channel has been predicted and illustrated by applying narrow gap theory[1, 2]. Experimental and numerical results show that it is possible to acquire not only fine droplets but also droplets with various speed and size by controlling separated section of the channel.

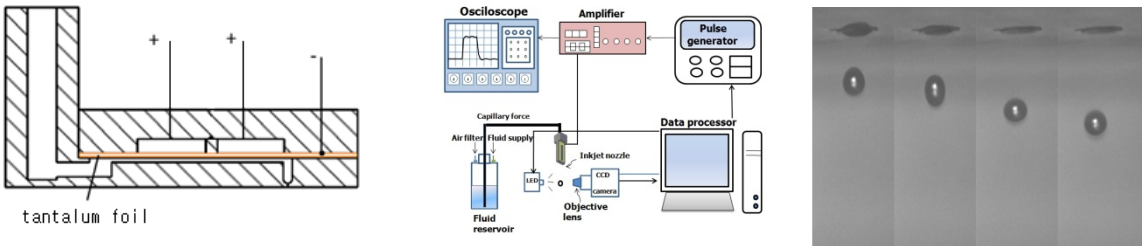

Fig. 1 Schematic of the piezoelectric nozzle (left), experimental set up (center), and successive images of droplet from the double-piezo actuator (right)

References

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