

Atomization phenomena with plate nozzle with a several ten micrometer slit

N. Iki*

Energy Technology Research Institute,
National Institute of Advanced Industrial Science and Technology (AIST)
1-2-1, Namiki, Tsukuba, Ibaraki, 305-8564, JAPAN

T. Ebara

Maruwa Electronic Incorporated

D. Shimizu

Graduate School of Kogakuin University

Abstract

Disintegration phenomena of thin liquid jet were investigated with optical instruments and thin planar nickel plate nozzles fabricated by electroforming process. The thickness of the nozzle is 0.02mm. The sizes of the rectangular slits are 0.02mm x 0.05mm, 0.02mm x 0.1mm and 0.04mm x 0.1mm. Ion exchanged water is sprayed vertically downward into static atmospheric air from small holes of thin plate nozzle. Injection pressure **Pi** is below 2MPa. Photographs of disintegration phenomena of the water jets are taken by digital camera and laser sheet of YAG laser. Sauter Mean Diameter **SMD** is measured by laser diffraction method. Mass flows rate of thin plate nozzles with slits are larger than those with circular hole. The coefficient of contraction of the slit is roughly around 0.8. Therefore the slit is effective to increase mass flow rate of thin plate nozzle. Water jet from thin plate nozzle with slit is already disintegrated into droplets at 6mm of **Lx** (distance from the nozzle hole exit). The droplets move inline. The interval of the droplets array becomes larger with **Lx**. **SMD** increases with **Lx**. The increase of **SMD** decreases with increase of **Lx**. **SMD** decreases with increase of **Pi**. These phenomena are similar to the sprays with thin plate nozzle with single circular hole. **SMD** with circular holes increases with **Dn**. **SMD** with thin plate nozzles with 0.04mm x 0.1mm slit agree with those with circular holes. **SMD** with thin plate nozzles with 0.02mm x 0.1mm slit are larger than those with circular holes. Therefore large aspect ratio of slit may decelerate disintegration of liquid jet and may disturb the coalescence of neighbor droplets. **SMD** with thin plate nozzles with circular holes increase with **Dn** and circular equivalent diameter is available for estimation of **SMD** slit nozzle except 0.02mm x 0.1mm slit.

Key words: Pressure Atomization, Plate Nozzle, Sauter Mean Diameter, Electroforming, Pinhole, Slit

*1Corresponding author, n-iki@aist.go.jp