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Development and application of an automatic measurement method for nozzle orifice diameter and length

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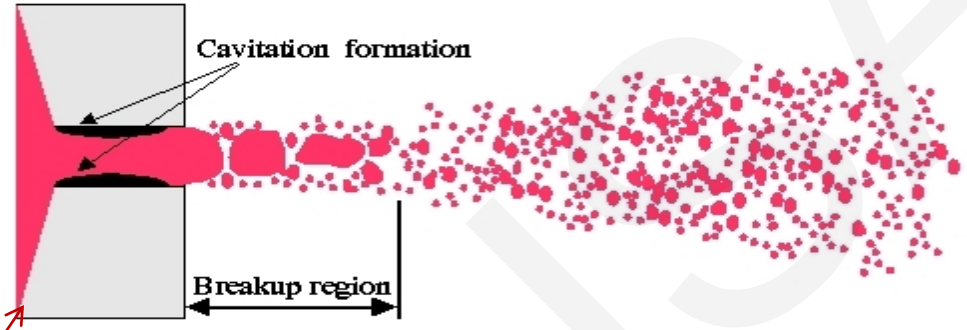
Fuel injector nozzle is important to engine



Spray characteristics

Fuel mass distribution

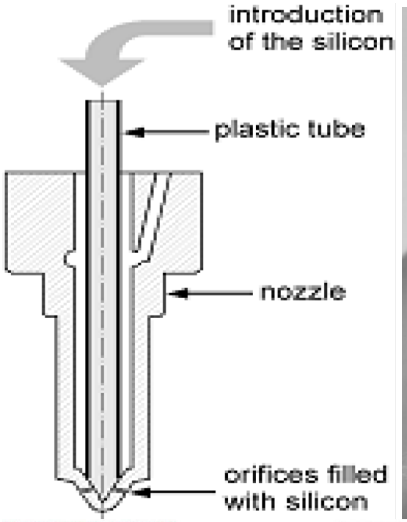
Combustion quality

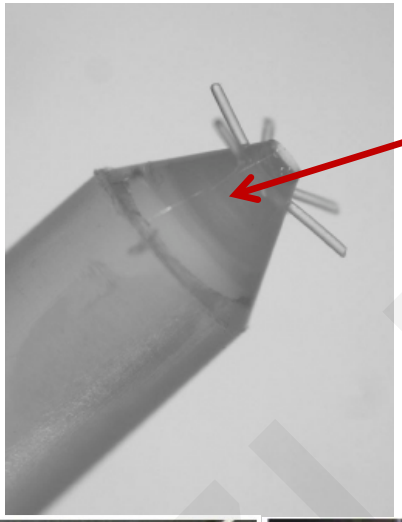
Power
Exhaust emissions
Efficiency

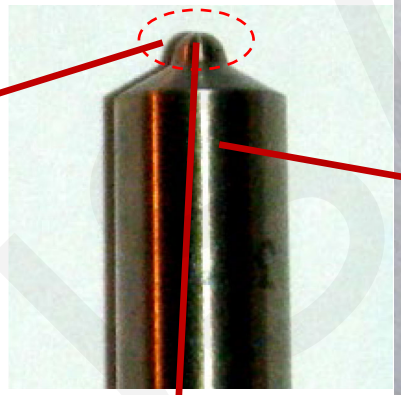
Nozzle orifice internal structure is difficult to measure

Silicon model method

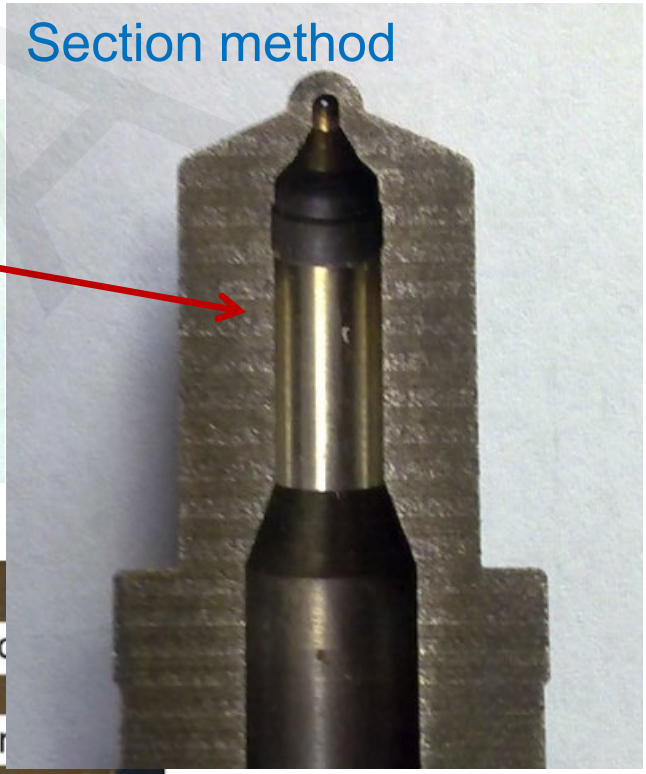
Macián, V et al.. Exp.Tech,2003, 27(2), 39-43.

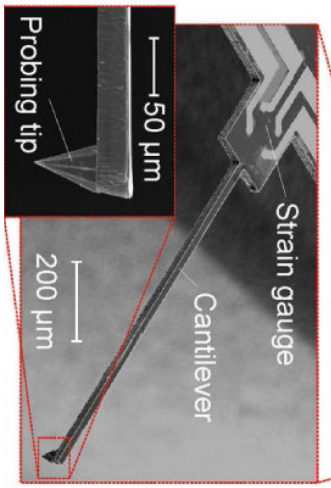


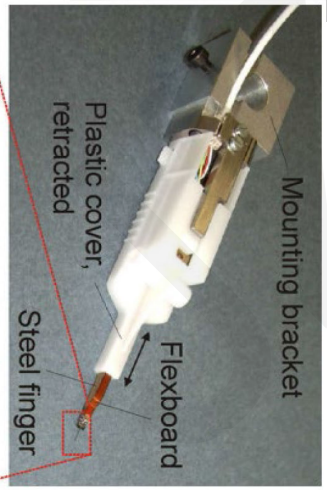


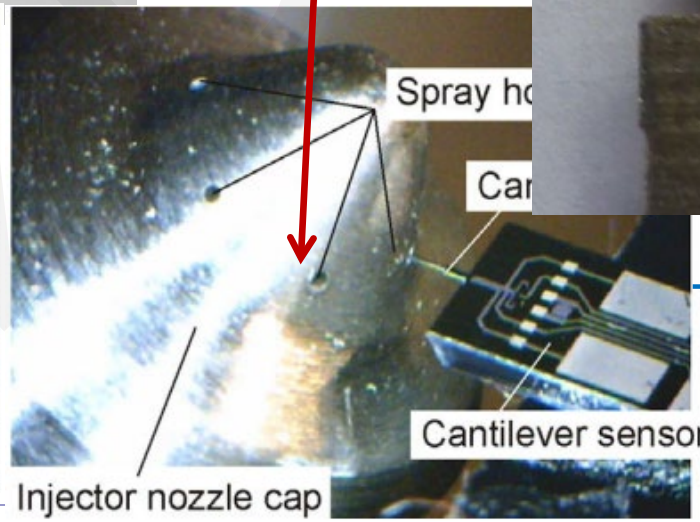


Section method





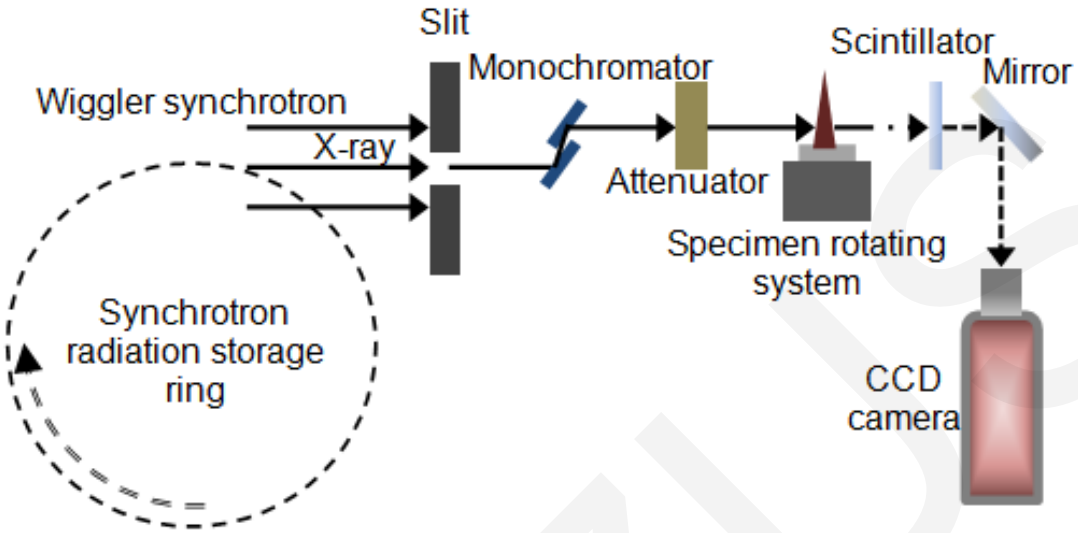




Tiny probe test method

Erwin Peiner et al, Microelectronic Engineering 86 (2009) 984–986.

Synchrotron X-ray CT Setup

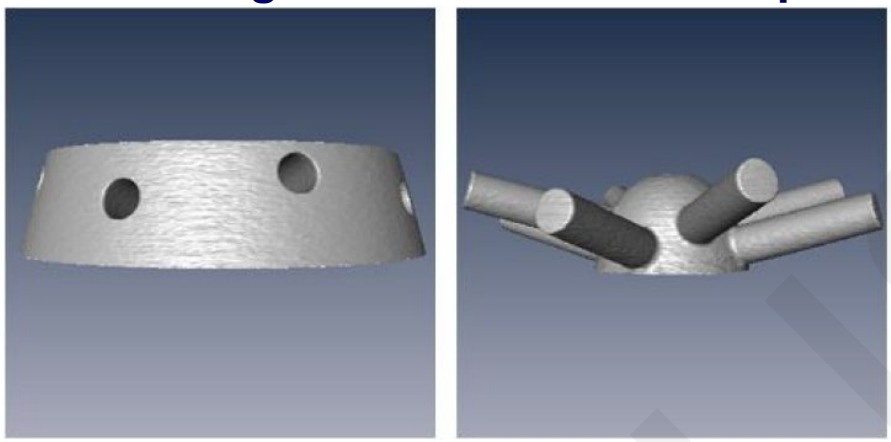


Sketch of the synchrotron x-ray micro-tomography test bench at the beam line BL13W1 of the Shanghai Synchrotron Radiation Facility

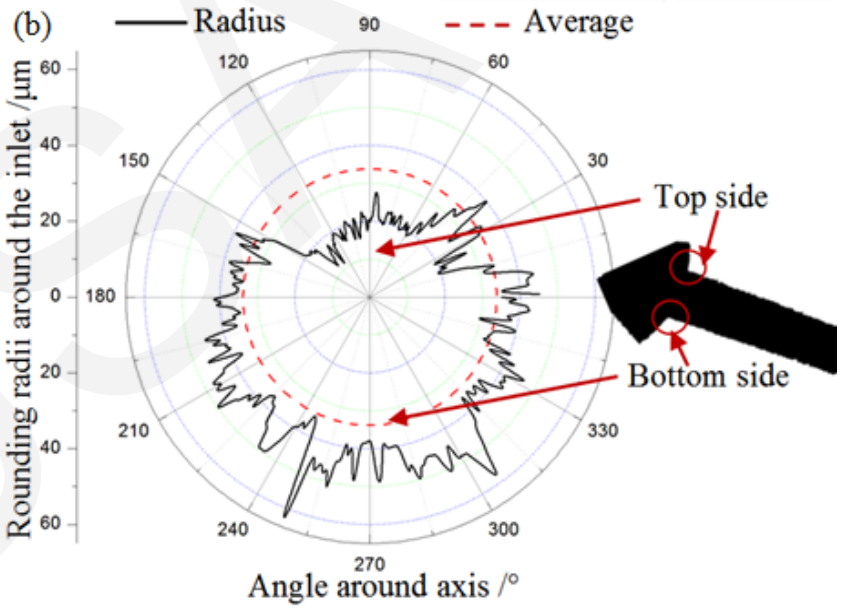
High energy synchrotron X-ray can penetrate the steel nozzle tip, reconstruct 3D structures of nozzle orifices.

Nozzle orifice internal structure measurement

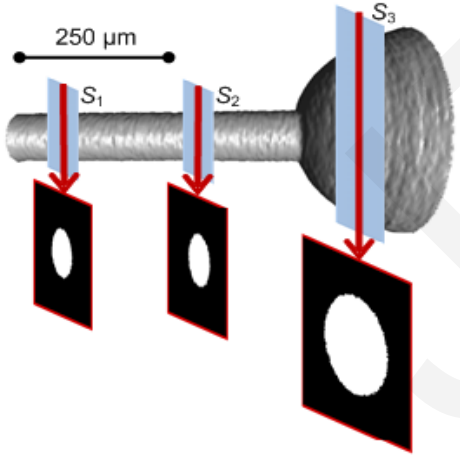
The 3D digital modes of nozzle tip [1]

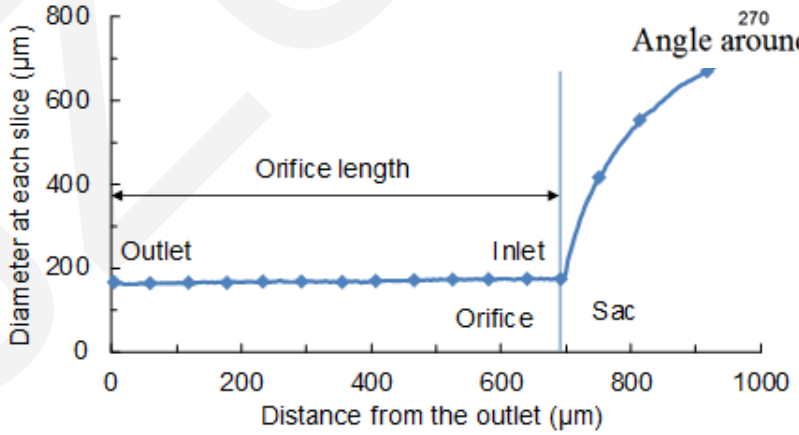


Inlet chamfer radius measurement [2]



Diameter distribution along axis





1. Wu, Z., J., Li, Z., L., Huang, W., D, et al. Journal of Zhejiang University-Science A, 2012, 13(3):182-188.
2. Zhilong Li, Zhijun Wu, Ya Gao, et al, CHINESE OPTICS LETTERS, 2014, 12(8):081201.

Conclusions

- This method is operable, the orifice diameters and lengths of single-hole and multi-hole nozzles can be measured regardless of the resolution and the source of the digital models.

- The pre-process method for the multi-hole nozzle is reasonable, by which the multi-hole nozzle can be treated as a single-hole nozzle to measure the diameters and lengths of its orifices.

Conclusions

- Clear definitions of orifice inlet and outlet have been drawn in this paper, and they provide a practical way to identify these important structures.

- The diameter profile along the whole orifice can be observed, which gives a new aspect to researching the manufacturing technology of nozzle orifices, and can also be used to describe the internal geometry features of the orifice for the simulation of fuel inner flow.