PEGASUS Software

CCP

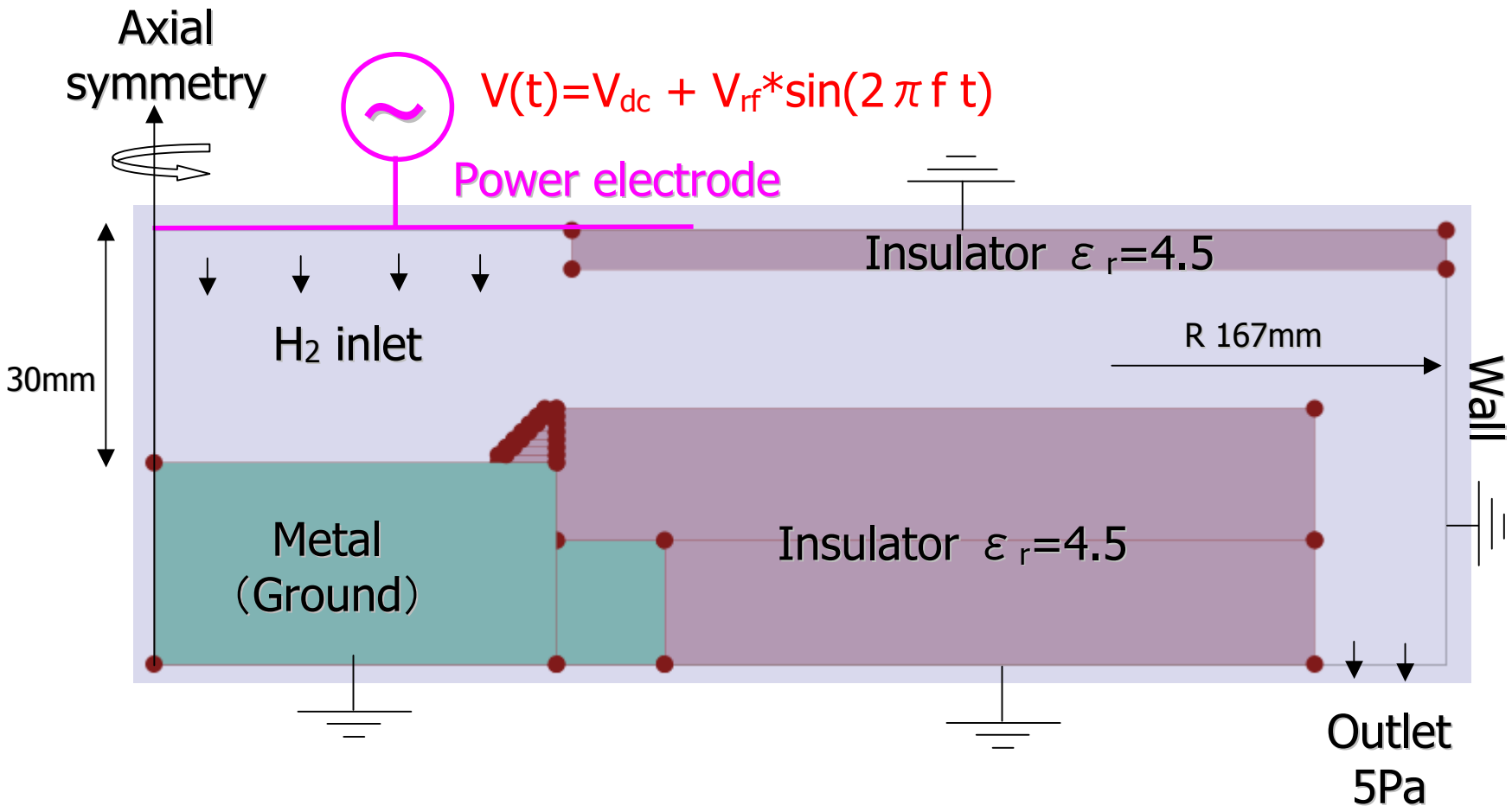
Hydrogen plasma simulation

Modules : PIC-MCCM
NMEM

Purpose

The simulation result and the measurement result in Prof. Hori Lab. of Nagoya University of the hydrogen plasma in a organic low-K etching reactor are compared.

Computational model



Computational conditions

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- Pressure 5 [Pa] （Fixed at outlet）
- Power electrode V_{rf}=200 [V] ; frequency 60[MHz]
- V_{dc}: Automatically calculated
- Flow rate 200[sccm]
- Species to be considered
  H_2, H, e^-, H^+, H_2^+, H_3^+, H^-
- Reactions on the wall
  H → 1/2H_2（Metal surface 15%　Insulator surface 7%）

Number density (electron, ions, Hydrogen atom)

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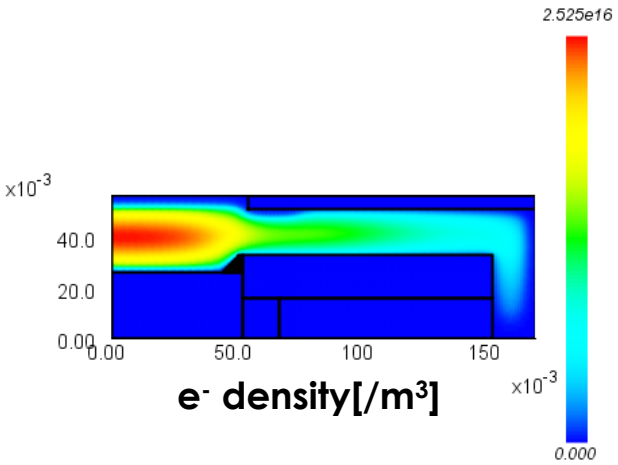

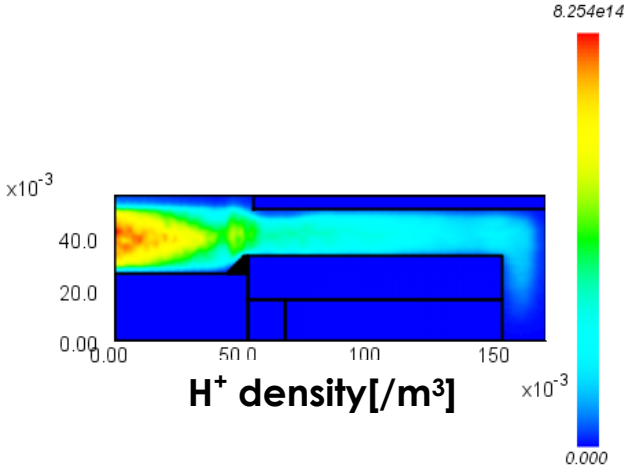

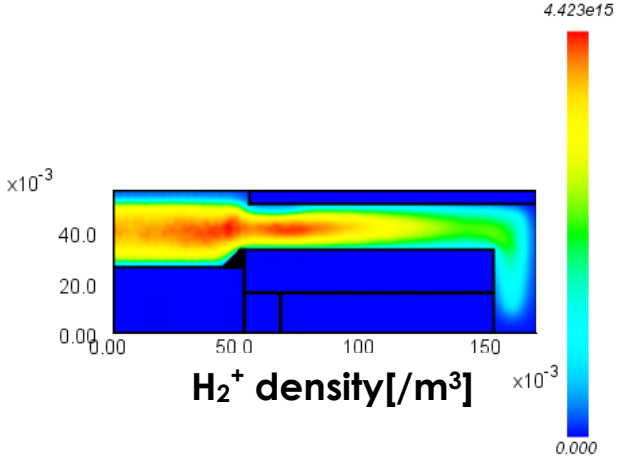

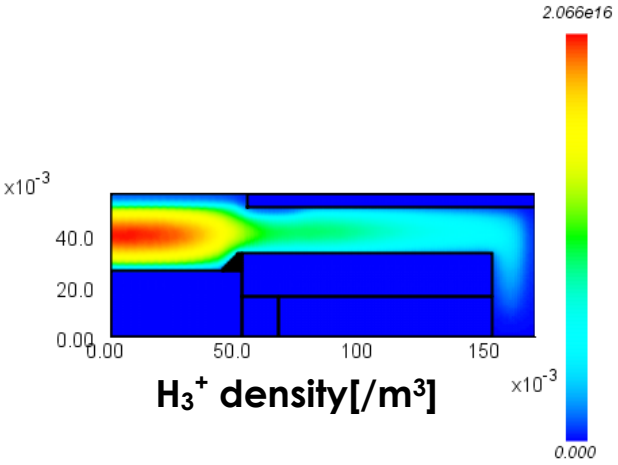

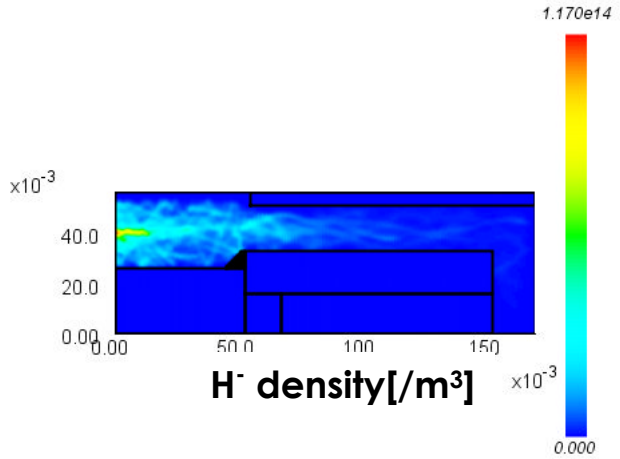

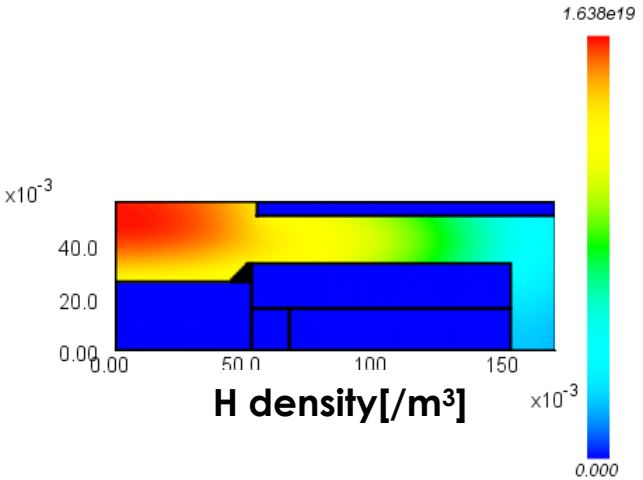

Electron temperature, Electric potential, Gas pressure, Flow velocity, and H flux

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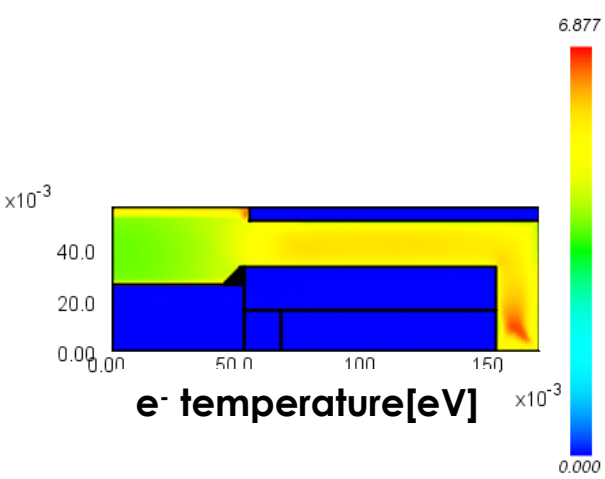

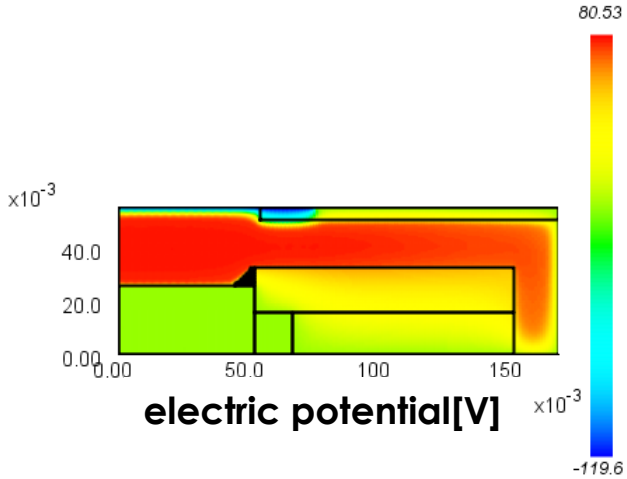

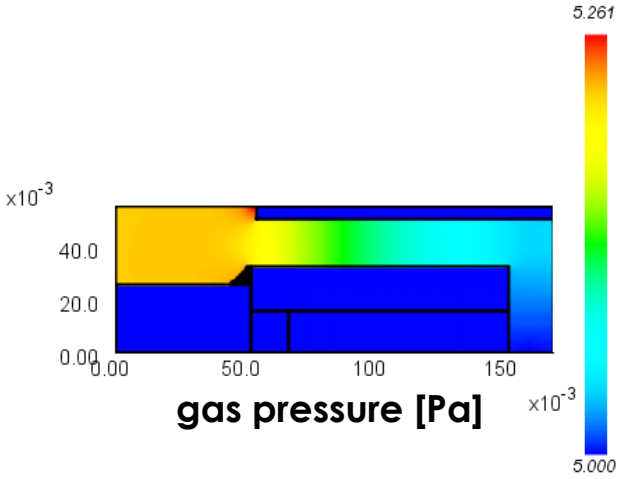

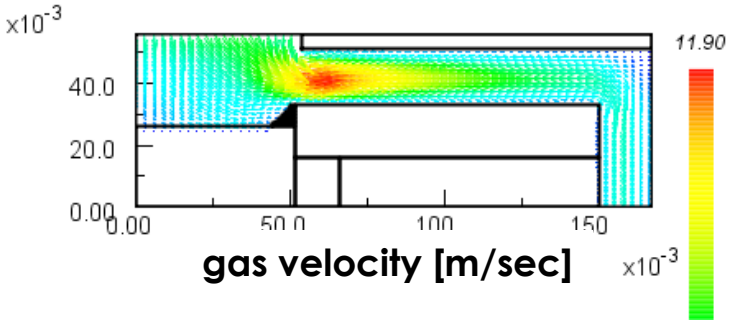

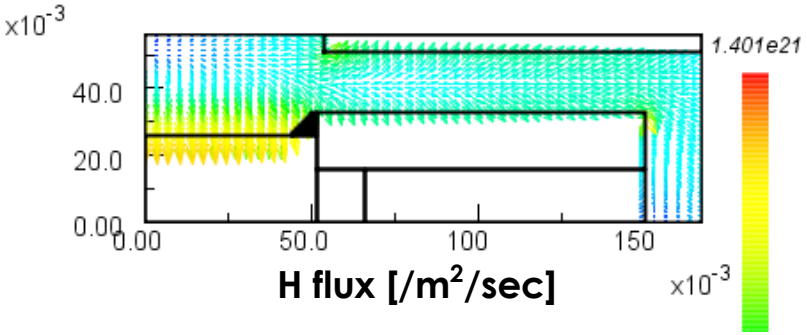

Simulation result compared with experiment

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quantity	Simulation(*)	experiment
Electron density [/cm^3]	1.44E10	1.6E10
H^+ density [/cm^3]	3.43E8	-
H_2^+ density [/cm^3]	3.45E9	-
H_3^+ density [/cm^3]	1.07E10	-
H^- density [/cm^3]	1.29E7	-
H density [/cm^3]	1.13E13	2.0E13
Electron temperature [eV]	5.17	6.8
Vdc [V]	-112	-114

(*) These are mean values over radial direction at the center of electrodes.