Investigation of Atmospheric Plasma Processing in Dielectric Barrier Discharge

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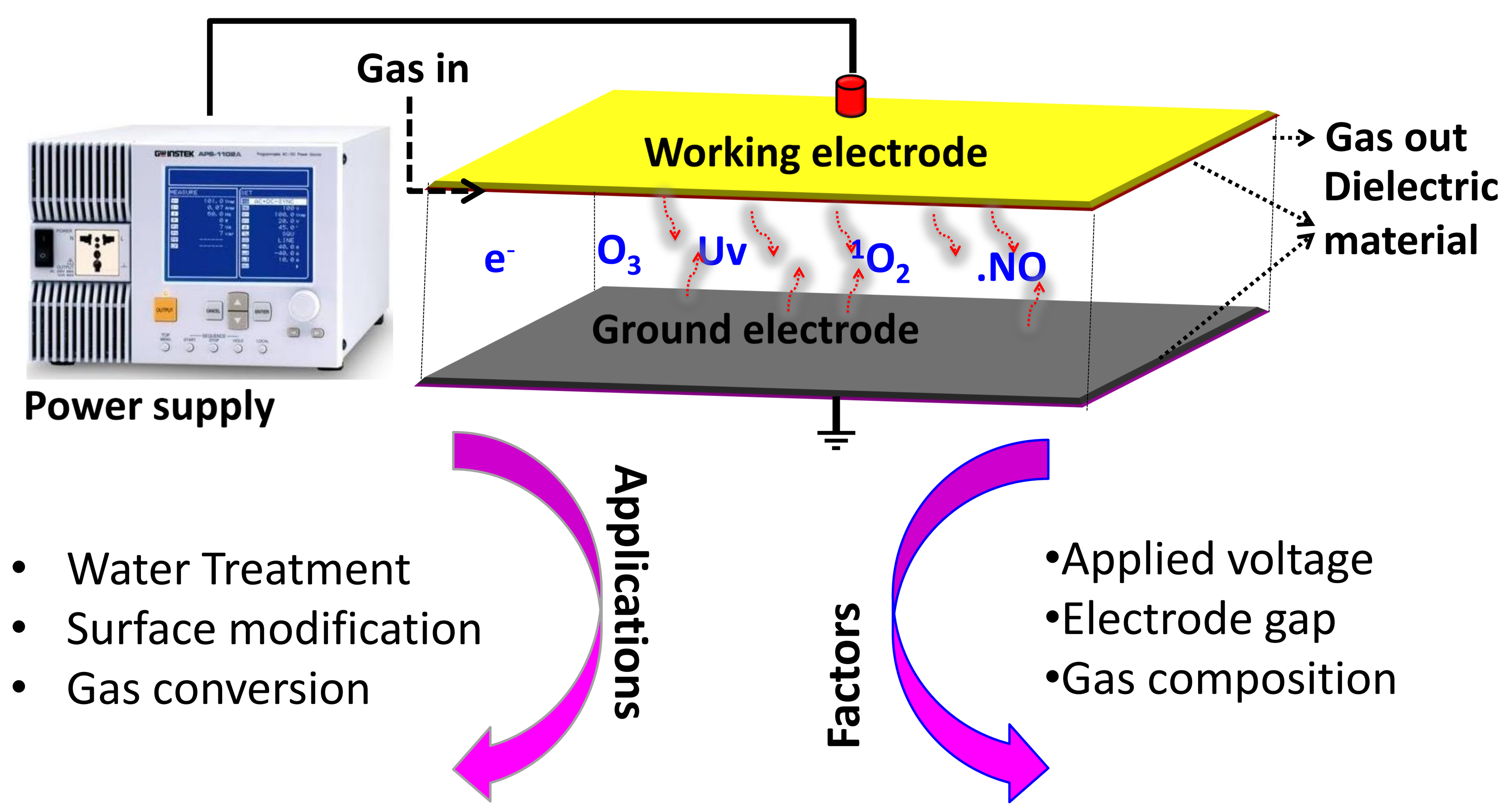
INTRODUCTION



Goal: Investigation of plasma parameters in DBD reactor at different discharge gap and dielectric material

COMPUTATIONAL METHODS:

Model equations

$$\frac{\partial n_e}{\partial t} + \nabla.\Gamma_e = R_e - (u.\nabla)n_e$$

$$\frac{\partial n_\epsilon}{\partial t} + \nabla.\Gamma_\epsilon + E.\Gamma_e = S_{en} - (u.\nabla)n_\epsilon + (Q + Q_{gen})/q$$

$$\Gamma_e = -(\mu_{en}.E)n_e - D_{en}.\nabla n_e$$

n_e – electron density; n_ε – electron energy density ; Γ -particle flux density; S -source and lose items of particles; μ_e – electron mobility; μ_e – electron mobility; μ_ε – electron energy mobility; D-diffusion co-efficient; E-electric field.

Geometrical condition

Variable	Value	Units
Length	0.1	m
Width	0.02	m
Area	0.002	m^2
Frequency	100	KHz

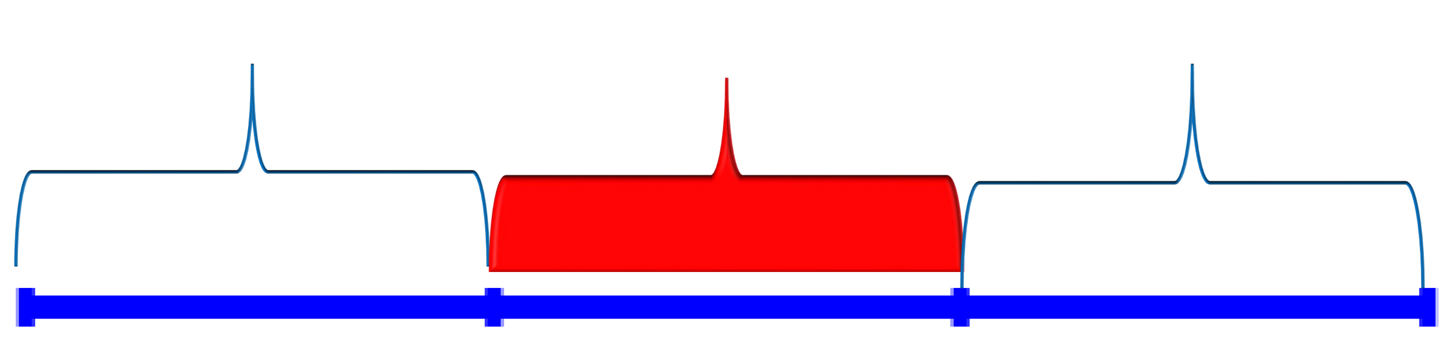


Figure 2. DBD reactor configuration

RESULTS

Effect of Discharge Gap

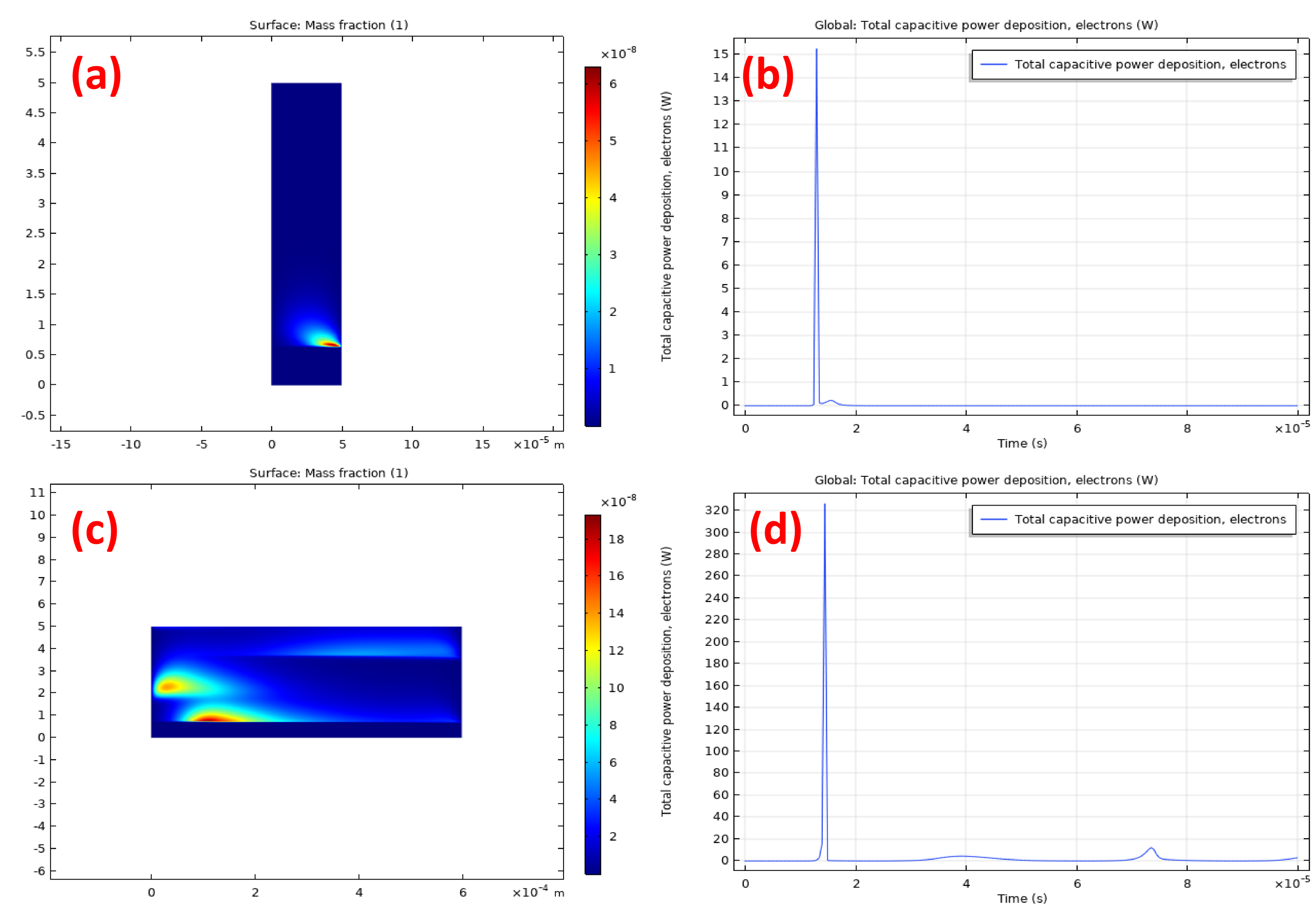
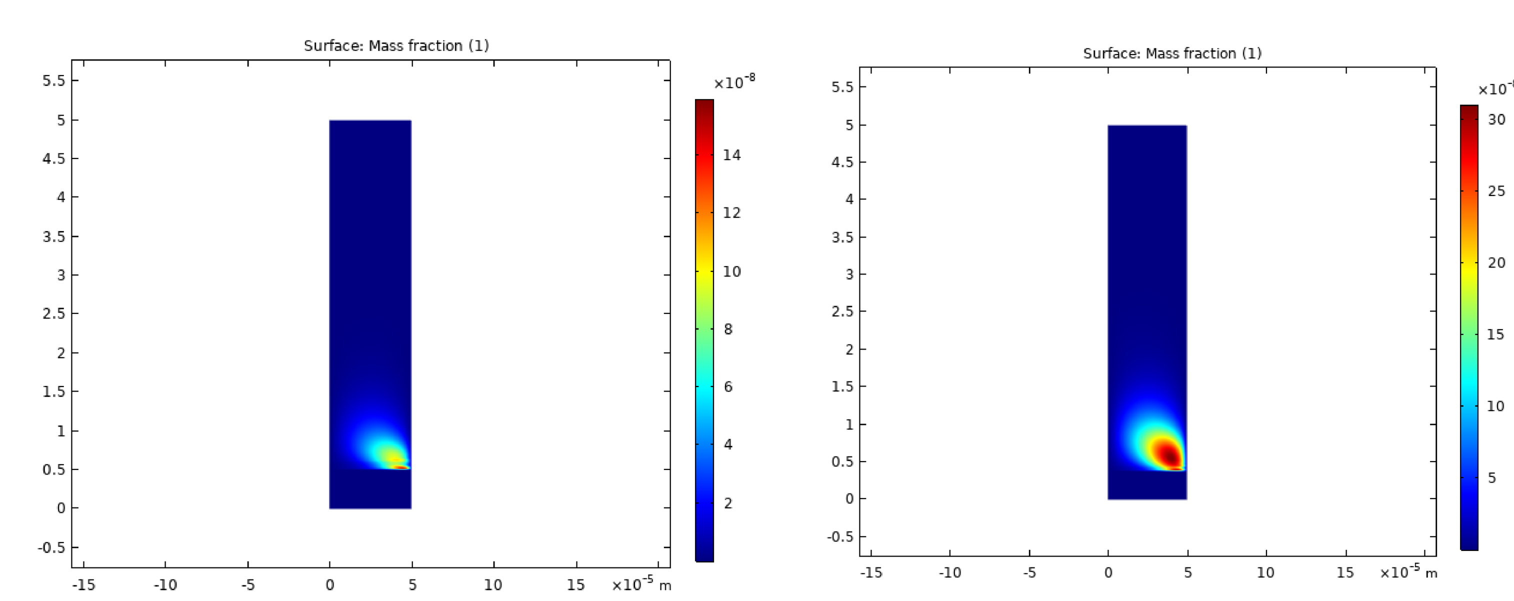
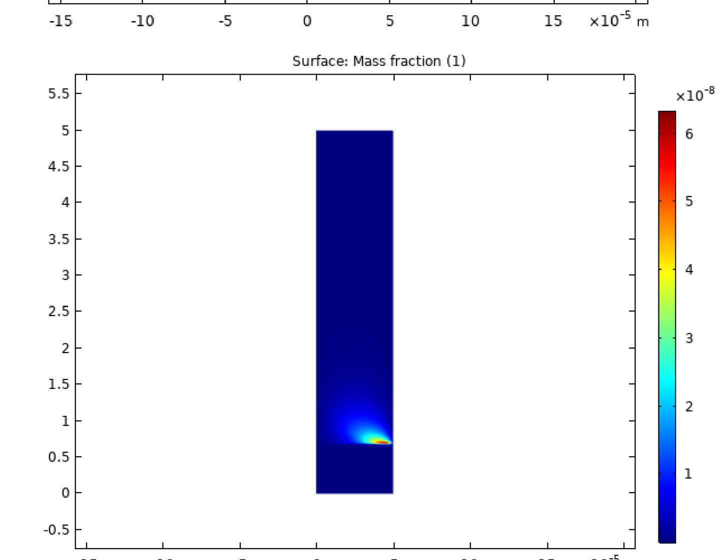


Figure 3. Plot of Argon mass fraction (a) $0.5*10^{-4}$ m; (c) $6*10^{-4}$ m and Total capacitive power deposition (b) $0.5*10^{-4}$ m; (d) $6*10^{-4}$ m

Type of material





Material	Dielectric constant
Quartz (glass)	4.2
Aluminum	1
Silicon	11.7
Acrylic	4

Figure 4. Plot of Argon mass fraction at different types of dielectric material (a) Aluminum; (b) Silicon; (c) Acrylic plastic

CONCLUSIONS:

- Power consumption was less in small discharge gap
- Generated plasma is unstable with increasing the discharge gap.
- Maximum value of mass fraction of Argon is observed in silicon than others.

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ACKNOWLEDGEMENTS

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