INRODUCTION

• Water Treatment
• Surface modification
• Gas conversion

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

COMPUTATIONAL METHODS:

Model equations

\[
\frac{\partial n_e}{\partial t} + \nabla \cdot \Gamma_e = R_e - (u \cdot \nabla) n_e
\]

\[
\frac{\partial n_e}{\partial t} + \nabla \cdot \Gamma_e + E \cdot \Lambda_e = S_{en} - \left( (u \cdot \nabla) n_e + (Q + Q_{gen})/Q \right)
\]

\[
\Gamma_e = -(\mu_{en} E) n_e - D_{en} \cdot \nabla n_e
\]

- \( n_e \) – electron density; \( n_e \) – electron energy density; \( \Gamma \) - particle flux density; \( S \) - source and lose items of particles; \( \mu_e \) – electron mobility; \( \mu_e \) – electron energy mobility; \( D \) - diffusion coefficient; \( E \) – electric field.

Geometrical condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0.1</td>
<td>m</td>
</tr>
<tr>
<td>Width</td>
<td>0.02</td>
<td>m</td>
</tr>
<tr>
<td>Area</td>
<td>0.002</td>
<td>m²</td>
</tr>
<tr>
<td>Frequency</td>
<td>100</td>
<td>KHz</td>
</tr>
</tbody>
</table>

Figure 2. DBD reactor configuration

RESULTS

Effect of Discharge Gap

Figure 3. Plot of Argon mass fraction (a) 0.5x10^-4 m; (c) 6x10^-4 m and Total capacitive power deposition (b) 0.5x10^-4 m; (d) 6x10^-4 m

Type of material

<table>
<thead>
<tr>
<th>Material</th>
<th>Dielectric constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz (glass)</td>
<td>4.2</td>
</tr>
<tr>
<td>Aluminum</td>
<td>1</td>
</tr>
<tr>
<td>Silicon</td>
<td>11.7</td>
</tr>
<tr>
<td>Acrylic</td>
<td>4</td>
</tr>
</tbody>
</table>

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.

REFERENCES:


ACKNOWLEDGEMENTS

This work was financially supported by Defense Research and Development Organization (DRDO).