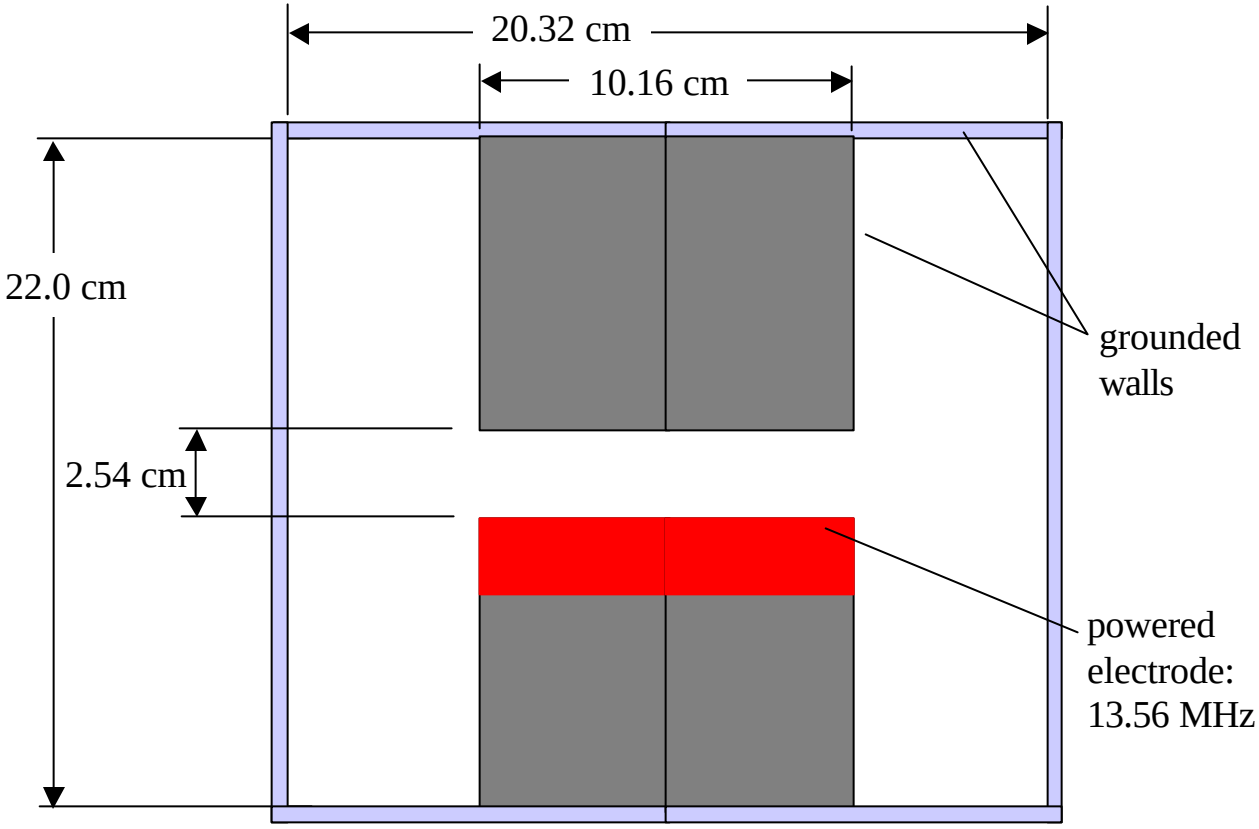
PLASMATOR SAMPLE
CCP AND ICP SIMULATIONS

SET 1

CAPACITIVELY COUPLED PLASMA

He / NF3 CHAMBER CLEAN

CCP SIMULATION: A CCP GEC Reference Cell is used for the Computational Geometry



Flow Parameters:

400 sccm He
100 sccm NF3
100-1500 mTorr
CCP ac bias : 200 V

CCP SIMULATION: PLASMATOR Utilizes Comprehensive Chemistry Models

Plasma Reactions

e	+	He	→	He	+	e	
e	+	He	→	He^+	+	e	+ e
e	+	He	→	He	+	e	+ hν
e	+	He	→	He*	+	e	
H_e*	+	NF_3	→	NF_3^+	+	e	+ He
H_e^+	+	NF_3	→	NF_3^+	+	He	
e	+	NF_3	→	NF_3	+	e	
e	+	NF_3	→	e	+	NF	+ F2
e	+	NF_3	→	e	+	NF_2	+ F
e	+	NF_3	→	NF_3^+	+	e	+ e
e	+	NF_3	→	e	+	e	+ NF2+ + F
e	+	NF_3	→	NF_2	+	F^-	
e	+	NF_2	→	NF_2	+	e	
e	+	NF_2	→	NF_2^+	+	e	+ e
e	+	NF	→	NF	+	e	
e	+	NF	→	NF^+	+	e	+ e
e	+	F_2	→	F_2	+	e	
e	+	F_2	→	F_2	+	e	
e	+	F_2	→	e	+	F	+ F
e	+	F_2	→	F^-	+	F	
e	+	F	→	F	+	e	
NF_2^+	+	F^-	→	NF	+	F_2	
NF_3^+	+	F^-	→	NF_2	+	F_2	
NF^+	+	F^-	→	NF	+	F	
F^+	+	NF_3	→	NF_2^+	+	F	+ F
NF^+	+	NF_3	→	NF_2^+	+	NF	+ F
F^-	+	N	→	NF	+	e	
F_2^+	+	F^-	→	F_2	+	F	
F^+	+	F_2	→	F_2^+	+	F	

Plasma Reactions (continued)

e	+	NF_3	→	NF_3	+	e	
e	+	NF_3	→	e	+	e	+ NF^+ + F_2
e	+	NF_3	→	e	+	e	+ F^+ + NF_2
e	+	N	→	N	+	e	
e	+	N	→	N^+	+	e	+ e
e	+	F_2	→	F_2^+	+	e	+ e
e	+	F	→	F	+	e	
e	+	F	→	F^+	+	e	+ e
e	+	F_2^+	→	F	+	F	
e	+	NF_3^+	→	NF_2	+	F	
e	+	NF_2^+	→	NF	+	F	
e	+	NF^+	→	N	+	F	
e	+	N_2^+	→	N	+	N	

Surface Reactions

NF_3^+			→	NF_3
NF_2^+			→	NF_2
F	+	F	→	F_2
He^+			→	He
He*			→	He
F_2^+			→	F_2
F^+			→	F
NF^+			→	NF
N^+			→	N
N	+	N	→	N_2
N	+	F	→	NF

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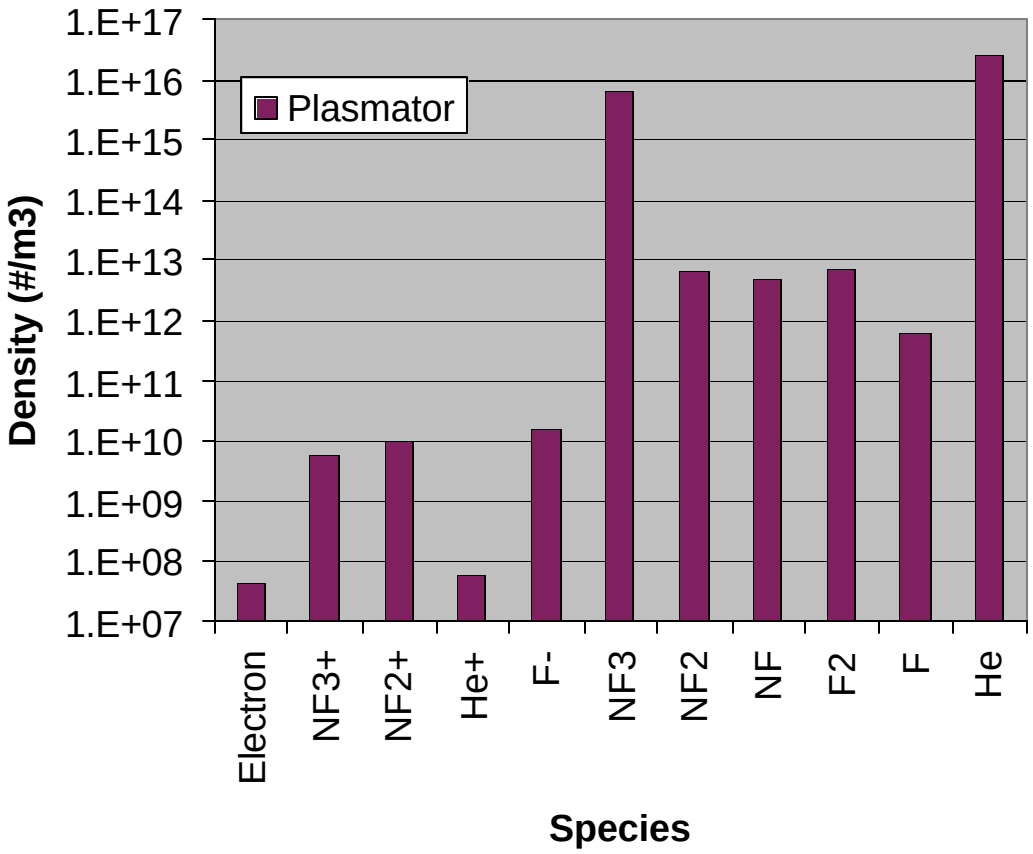
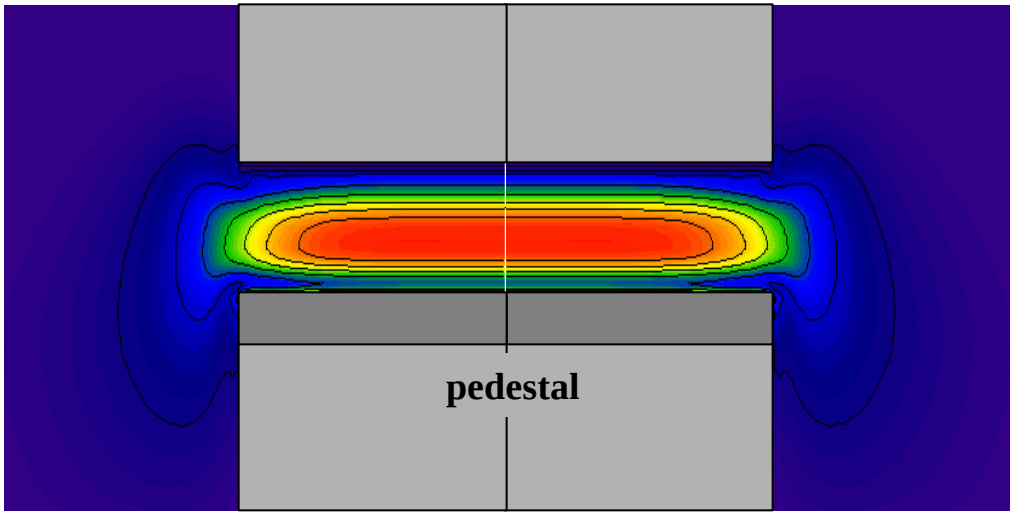
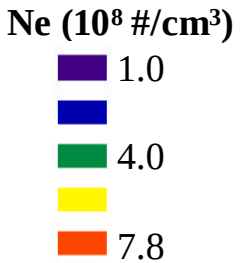
CCP SIMULATION: PLASMATOR RESULTS – Average Species Concentrations



CCP SIMULATION: PLASMATOR RESULTS - Electron Density

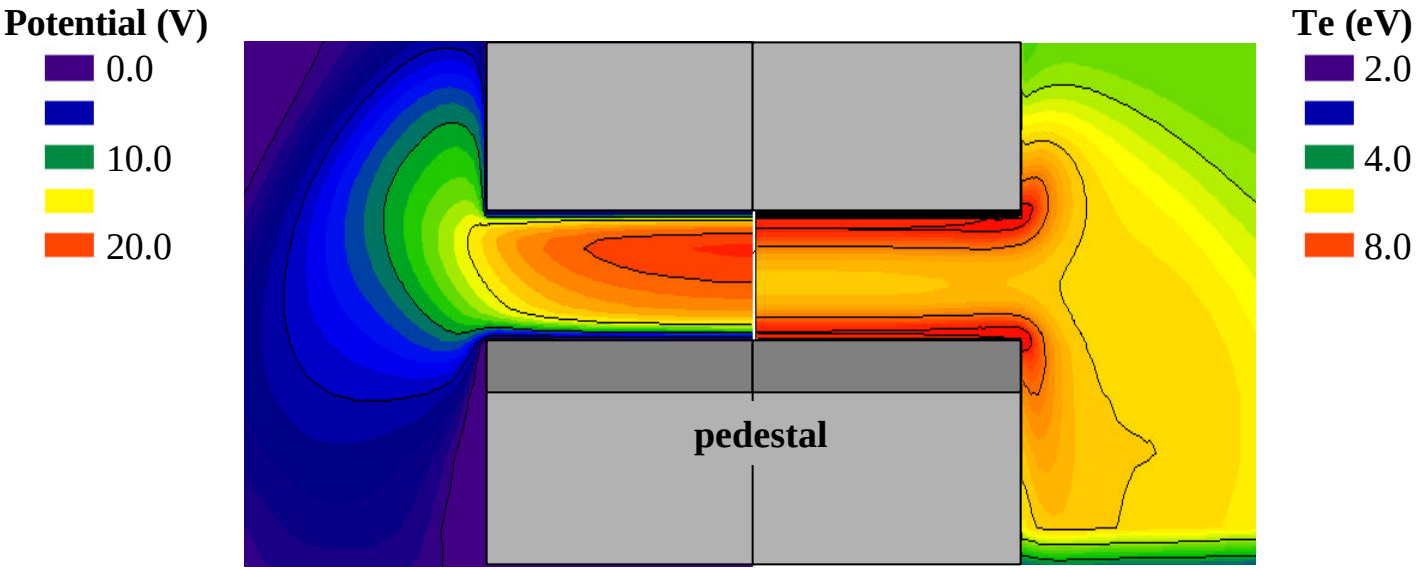




Flow Parameters:

400 sccm He
100 sccm NF3
1000 mTorr
200 V ac bias

CCP SIMULATION: PLASMATOR RESULTS - Electron Temperature and Plasma Potential



Flow Parameters:

400 sccm He
100 sccm NF3
1000 mTorr
200 V ac bias

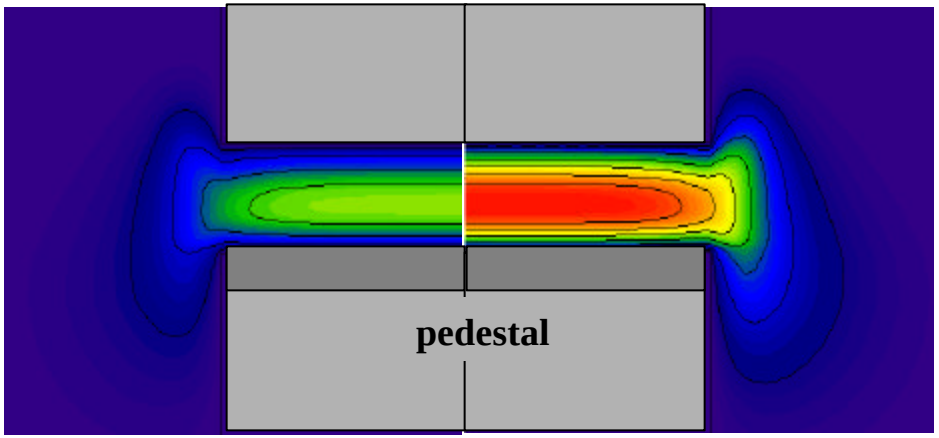
CCP SIMULATION: PLASMATOR RESULTS - Ion Densities

NF3+ (10^{11}#/cm^3)

0.2

0.8

1.4



NF2+ (10^{11}#/cm^3)

0.2

0.8

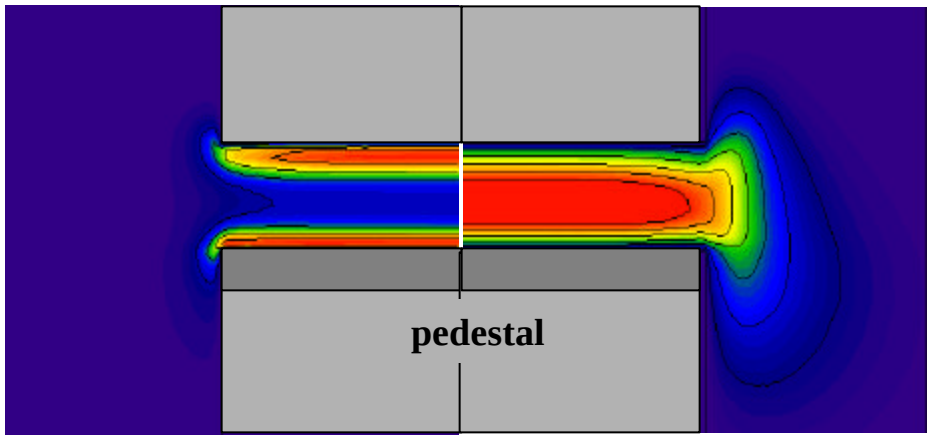
1.4

He+ (10^{9}#/cm^3)

0.0

1.2

2.5



F$^-$ (10^{10}#/cm^3)

0.1

1.1

2.2

Flow Parameters:

400 sccm He

100 sccm NF3

1000 mTorr

200 V ac bias

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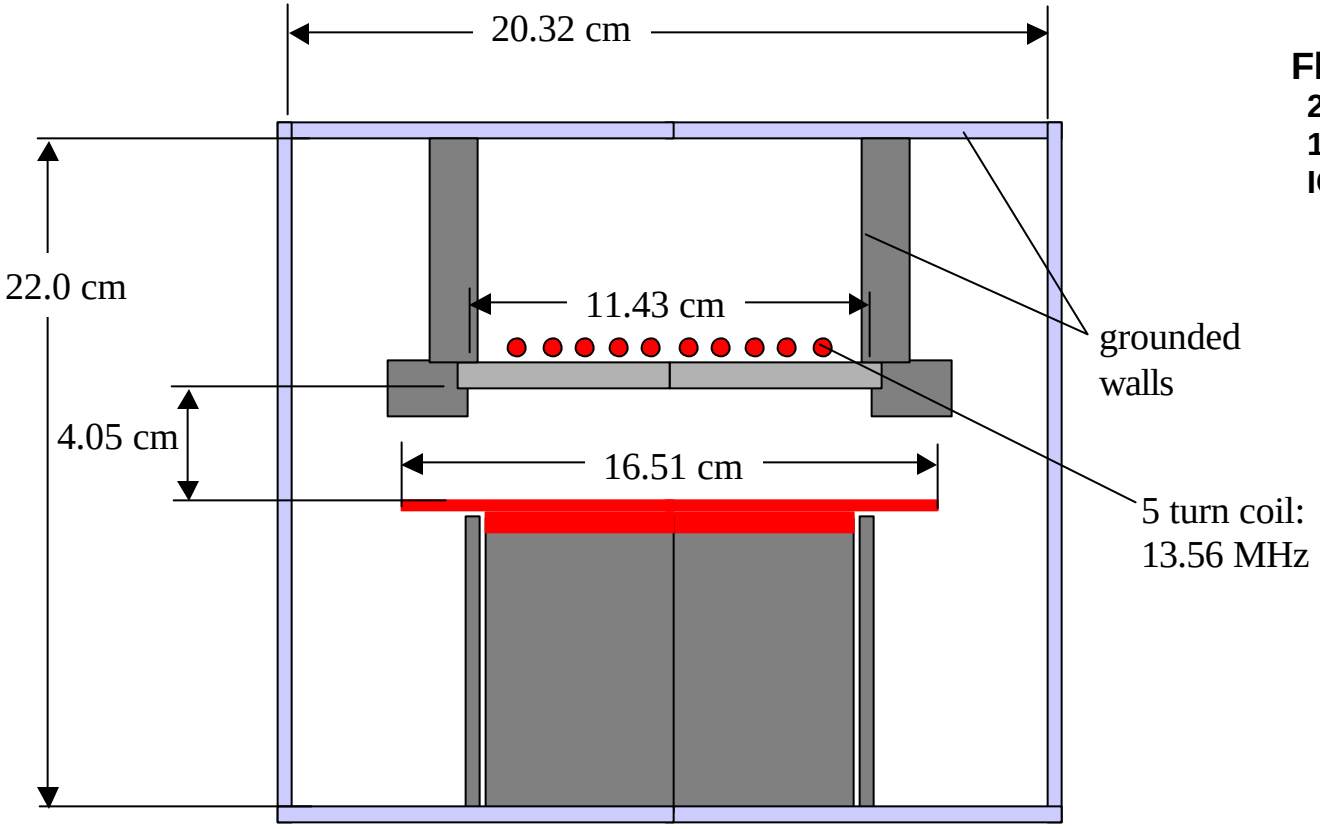
INDUCTIVELY COUPLED PLASMA

OXIDE DEPOSITION

ICP SIMULATION: An ICP GEC Reference Cell is used for the Computational Geometry



Flow Parameters:
20 sccm Ar
10 mTorr
ICP power : 150 W

ICP SIMULATION: PLASMATOR Utilizes Comprehensive Chemistry Models

Plasma Reactions

e	+	Ar	→	Ar	+	e		
e	+	Ar	→	Ar^+	+	e	+	e
e	+	Ar	→	Ar	+	e	+	hν
e	+	Ar	→	Ar*	+	e		
e	+	O_2	→	O_2	+	e		
e	+	O_2	→	O_2	+	e	+	hν
e	+	O_2	→	O_2^+	+	e	+	e
e	+	O_2	→	O_2*	+	e		
e	+	O_2	→	O_2*	+	e		
e	+	O_2	→	e	+	O	+	O
e	+	O_2	→	O	+	O^-		
e	+	O	→	O	+	e		
e	+	O	→	O^+	+	e	+	e
e	+	O	→	O*	+	e		
e	+	O	→	O*	+	e		
e	+	O_2*	→	e	+	O	+	O
e	+	O_2*	→	O	+	O^-		
e	+	O_2*	→	O_2^+	+	e	+	e
e	+	O_2^+	→	O	+	O		
e	+	O_2^+	→	O	+	O*		
Ar*	+	O_2	→	Ar	+	O	+	O*
Ar^+	+	O_2	→	O_2^+	+	Ar		
O^-	+	O	→	O_2	+	e		
O^-	+	O_2*	→	O_3	+	e		
O^-	+	O_2^+	→	O	+	O_2		

Plasma Reactions (continued)

e	+	SiH_4	→	SiH_4	+	e		
e	+	SiH_4	→	e	+	SiH_3	+	H
e	+	SiH_4	→	H	+	SiH_3^+	+	2 e
e	+	SiH_4	→	H_2	+	SiH_2^+	+	2 e
e	+	SiH_3	→	SiH_3^+	+	e	+	e
e	+	SiH_2	→	SiH_2^+	+	e	+	e
e	+	SiH	→	SiH^+	+	e	+	e
e	+	H_2	→	e	+	H	+	H
e	+	SiH_3^+	→	SiH_2	+	H		
O	+	SiH_4	→	OH	+	SiH_3		
Si	+	O_2	→	SiO	+	O		
O_2	+	SiH	→	SiO	+	OH		
O_2^+	+	SiH_4	→	SiH_3^+	+	O_2	+	H
O_2^+	+	SiH_4	→	SiH_2^+	+	O_2	+	H_2
SiH_2^+	+	SiH_4	→	SiH_3^+	+	SiH_3		
O^-	+	SiH_3^+	→	SiH_2	+	OH		

Surface Reactions

Ar^+			→	Ar
O^+			→	O
O_2^+			→	O_2
O	+	O	→	O_2
Ar*			→	Ar
O_2*			→	O_2
O*			→	O
SiH_3^+			→	SiH_3
SiH_2^+			→	SiH_2
SiH^+			→	SiH
H	+	H	→	H_2

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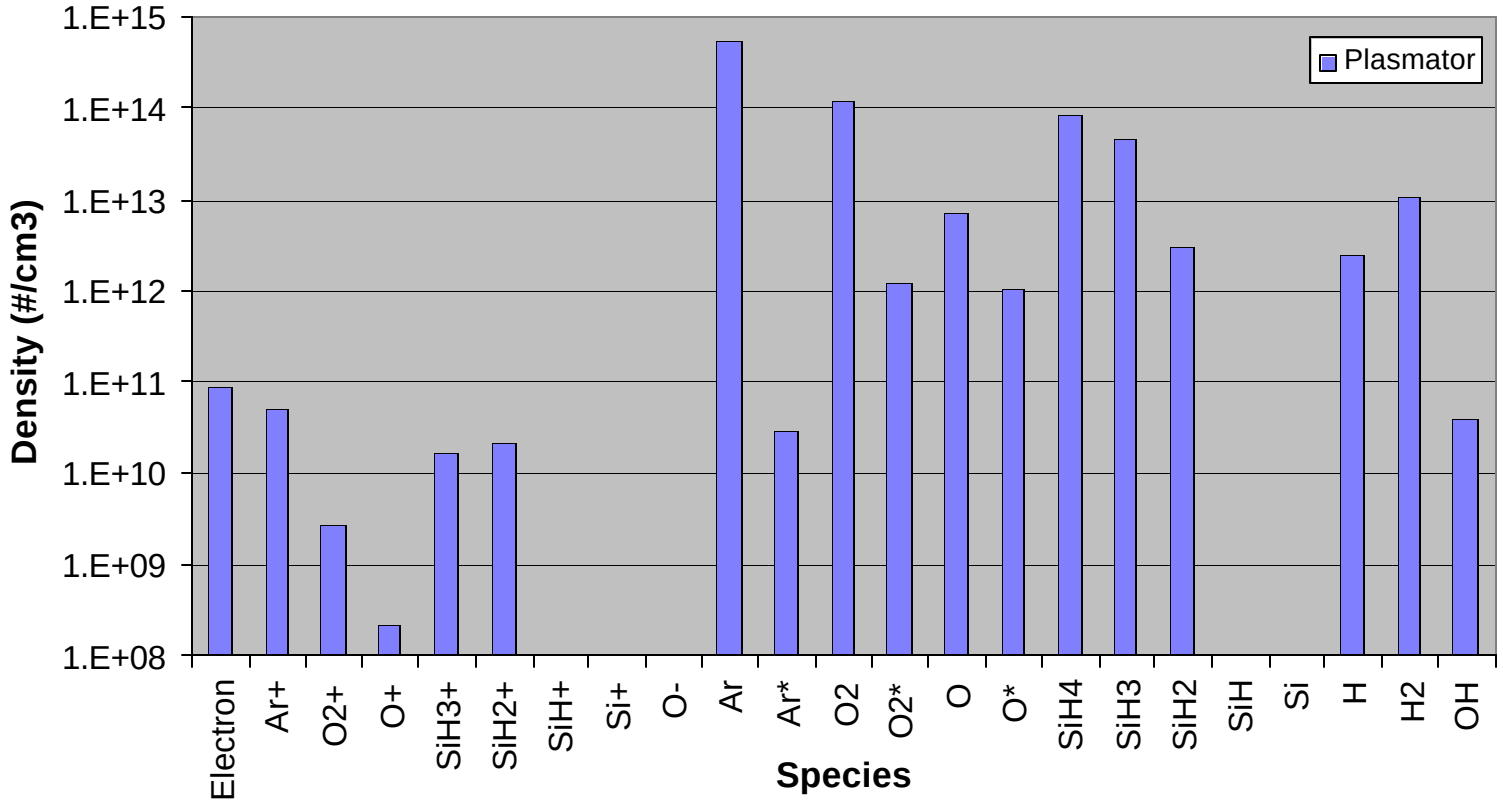
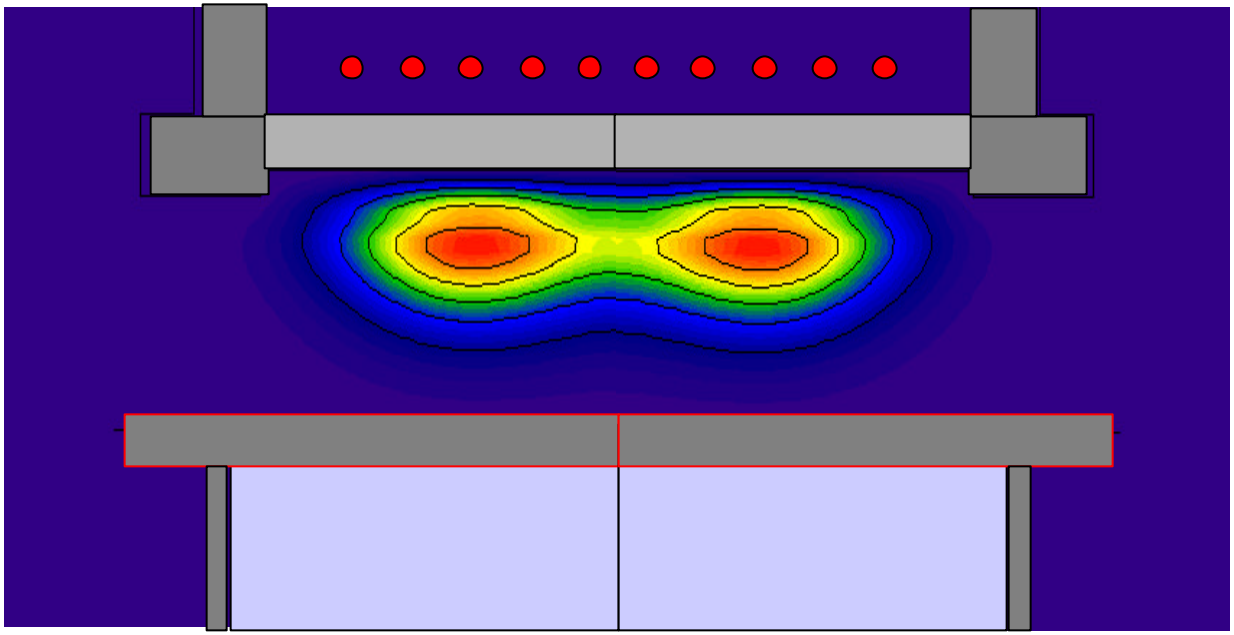
ICP SIMULATION: PLASMATOR Results – Average Species Concentrations



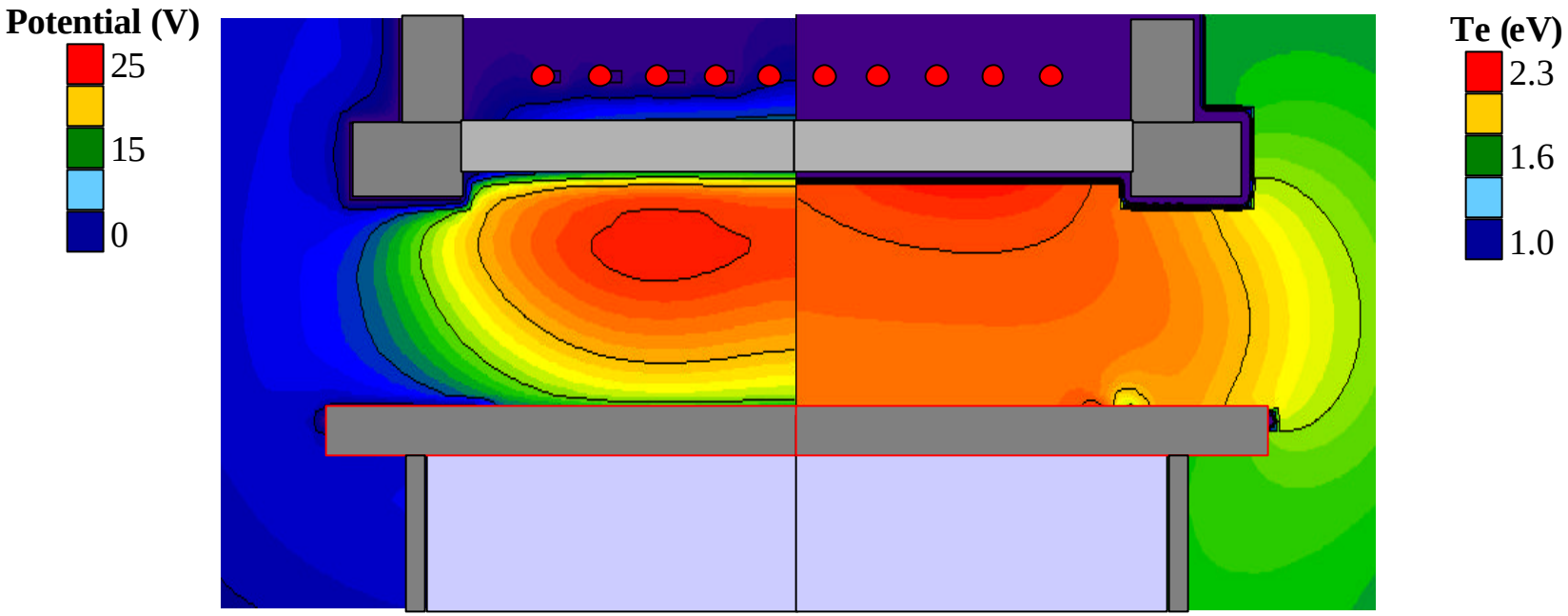
ICP SIMULATION: Plasmator Results-
Electron Density



Flow Parameters:

100 sccm Ar
25 sccm O2
25 sccm SiH4
25 mTorr
350 W ICP

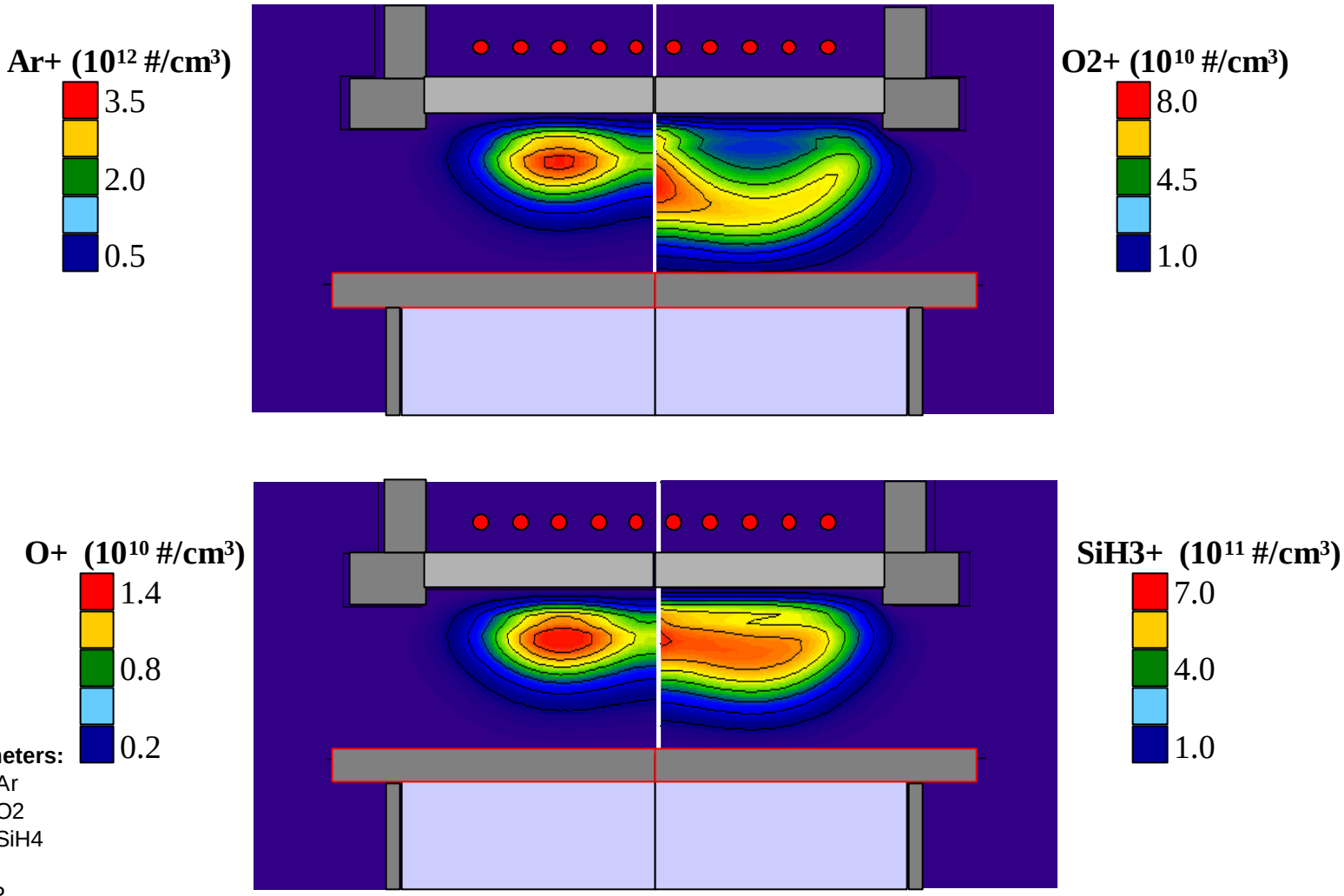
ICP SIMULATION: Plasmator Results – Electron Temperature and Plasma Potential



Flow Parameters:

100 sccm Ar
25 sccm O2
25 sccm SiH4
25 mTorr
350 W ICP

ICP SIMULATION: Plasmator Results-
Dominant Ion Densities



Flow Parameters:
100 sccm Ar
25 sccm O2
25 sccm SiH4
25 mTorr
350 W ICP

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