

# Project GWU # 3

- **Title:** Discharge Initiation
- **PI(s):** Michael Keidar and Irina Schweigert, George Washington University
- **Need and Relevance:** simulation of discharge initiation
- **Goals:** to develop understanding of the mechanism of discharge initiation and approaches to control it
- **Approach:** develop new kinetic code, hypothesis and validation
- **Outcomes/Deliverables:** code validation
- **Project Duration, Budget:** 2 years / \$45k/year

# Need and Relevance

Accurate prediction of plasma-surface coupling

Effect of surface conditions on electron emission and discharge initiation

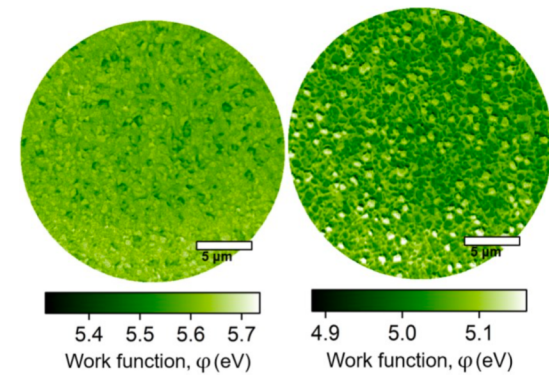
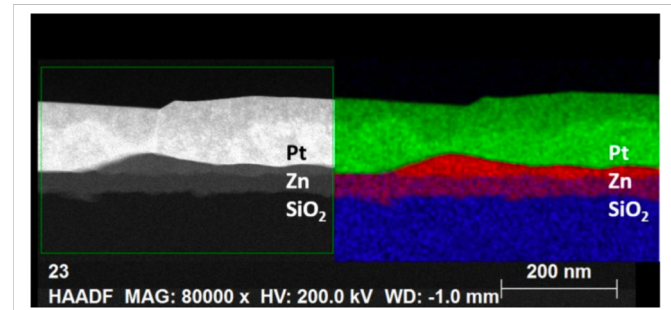
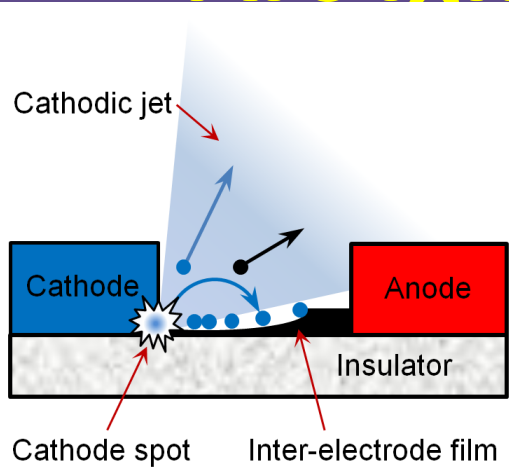
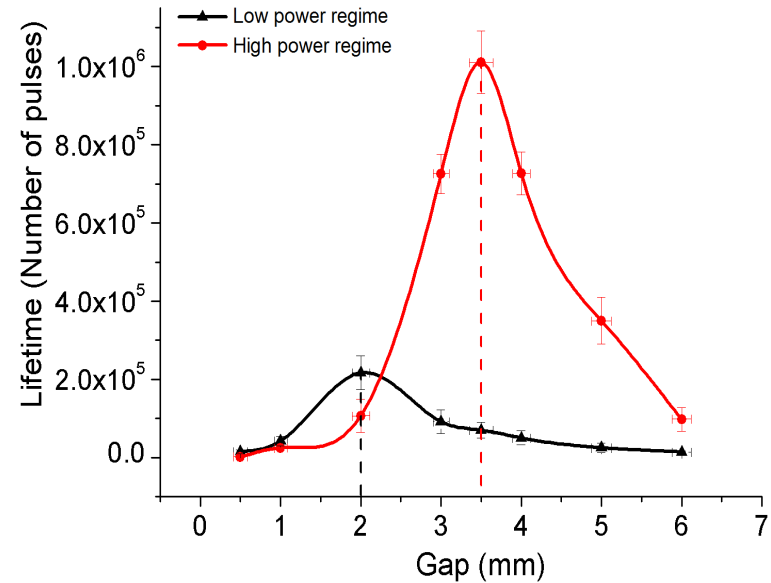


Fig. 2. PEEM measurements of effective work function. Left is freshly prepared (clean), right is after air exposure (dirty).

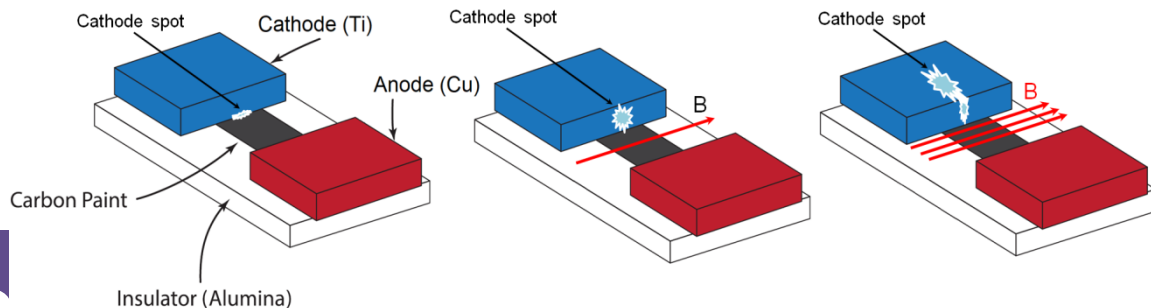
# Arc Ignition in Micro-CAT



- - cathode particles
- - film particles



Zolotuchin & Keidar., Plasma Source Sci Technol., 2018



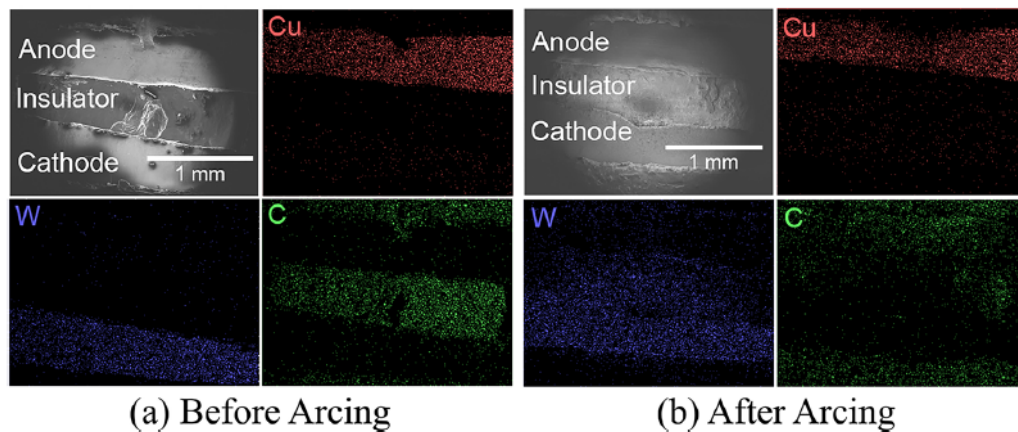
# Goals

## Understanding Mechanism and Control of Discharge Initiation

- Time for initiation dependence on interelectrode gap
- Effect of electrode surface conditions on discharge initiation time
- Dependence on pressure

# Approach

- Precise control of surface state , monitoring using atomic force microscopy (AFM) and SEM/TEM
- Kinetic modeling of the initiation process

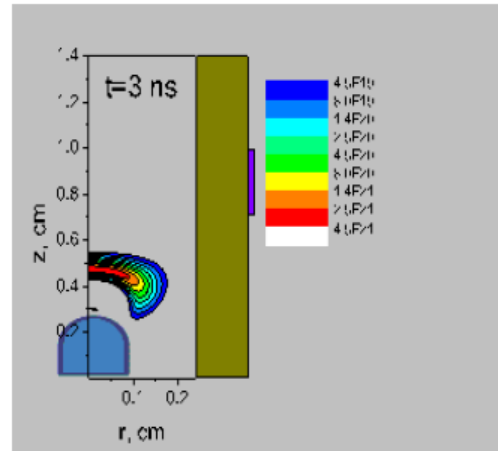
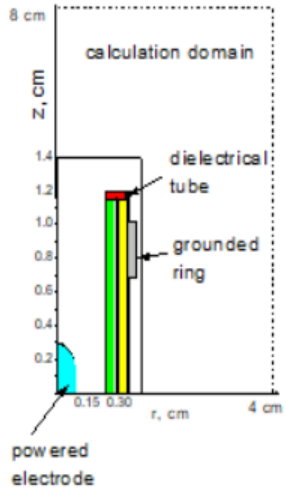


Teel et al., J. Appl. Phys., 2017

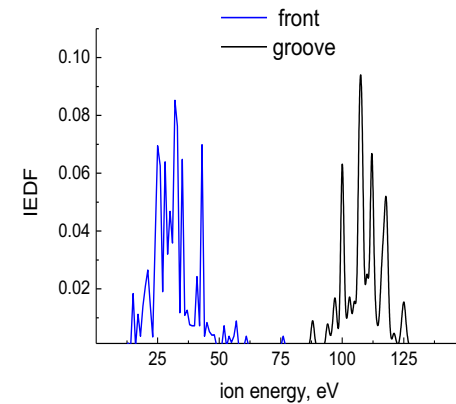
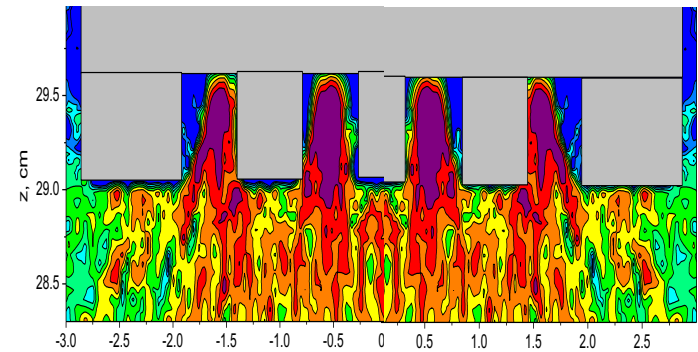


# Approach

## Kinetic simulations of CAP jet



## Kinetic simulations of plasma-wall interactions



# Outcomes/Deliverables

**Kinetic code validation to predict time for discharge initiation dependence on interelectrode gap**

**Effect of electrode surface conditions on initiation and pressure dependence**

# Project Timeline and Duration

Task / month	1	2	3	4	5	6	7	8	9	10	11	12
Time for initiation dependence on gap	x	x	x	x								
Electrode surface conditions effect				x	x	x	x	x				
Dependence on pressure								x	x	x	x	x



# Project Budget

Item	Cost
Post-doc support	\$ 35,000.00
Supplies	\$ 7,000.00
Purchased services	\$ 0.00
Equipment	\$ 0.00
Travel	\$ 3,000.00
<b>Project total*</b>	<b>\$ 45,000</b>