

3. Principles to Plasma Surface Activation Treatment

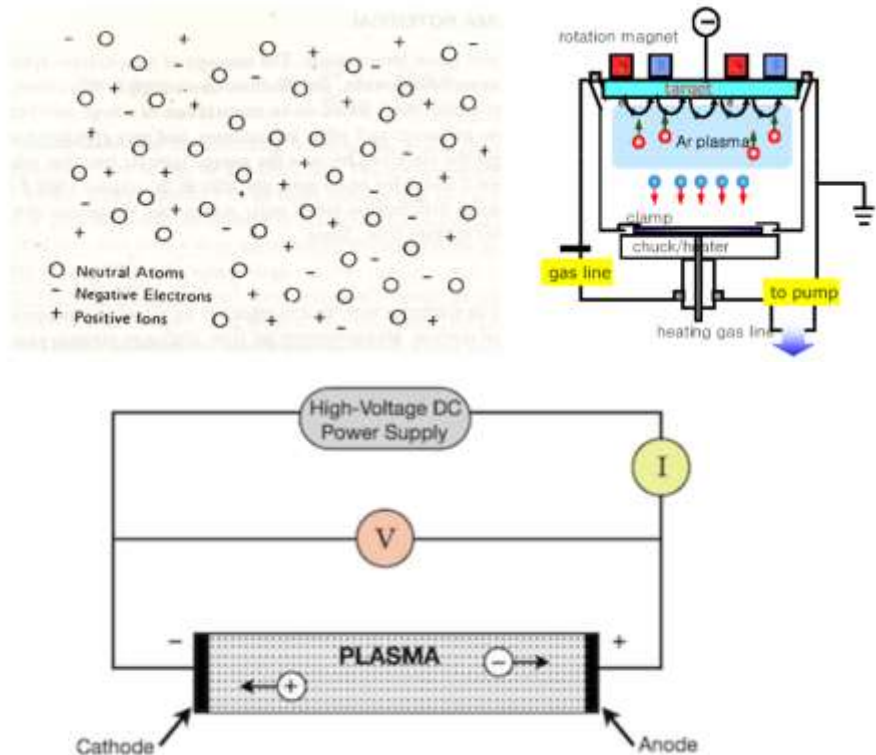
3.3 Plasma energy for activation process (1/3)

PLASMA ? : Non Conductive Neutral Gas → Conductive Charged Particles

Plasmas

a partially ionized gas consisting of equal numbers of positive (ions) and negative (electrons) charges, and a different number of un-ionized neutral molecules

- 1) continuous creation of ion-electron pairs by ionization
- 2) continuous destruction by recombination
- 3) pair-wise process and charge neutral
- 4) photon emission by the processes of excitation and relaxation



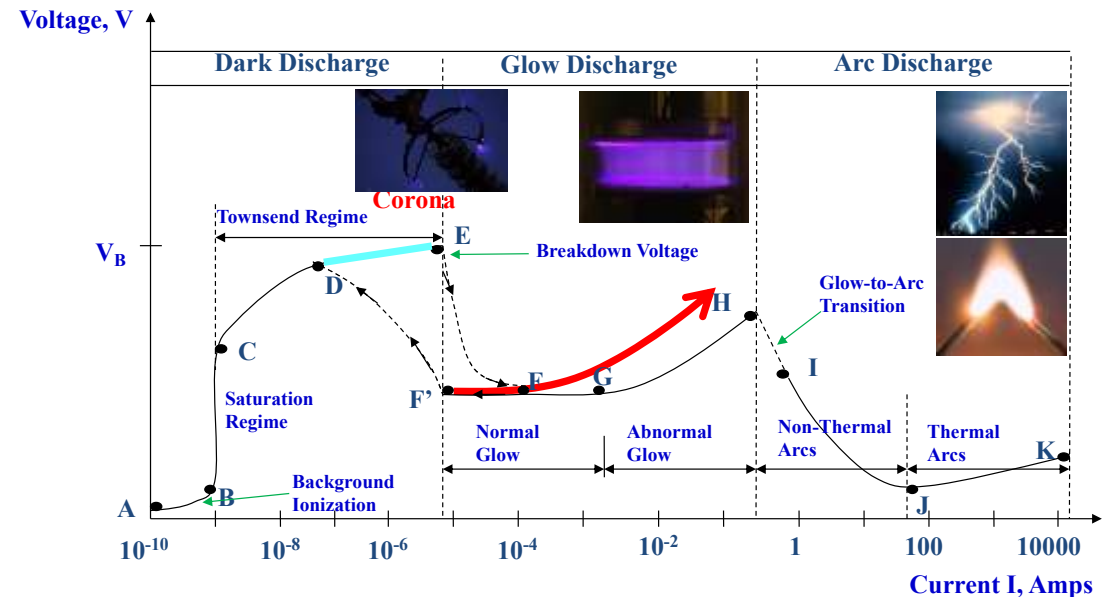
60kV Plasma Accelerator 연구 결과

자료유형 학위논문

서명/저자사항 High voltage plasma diode electron beam accelerator and application to tool steel heat treatment / Eun Goo Kang

개인저자 Kang, Eun-goo

Gas Discharging Characteristics



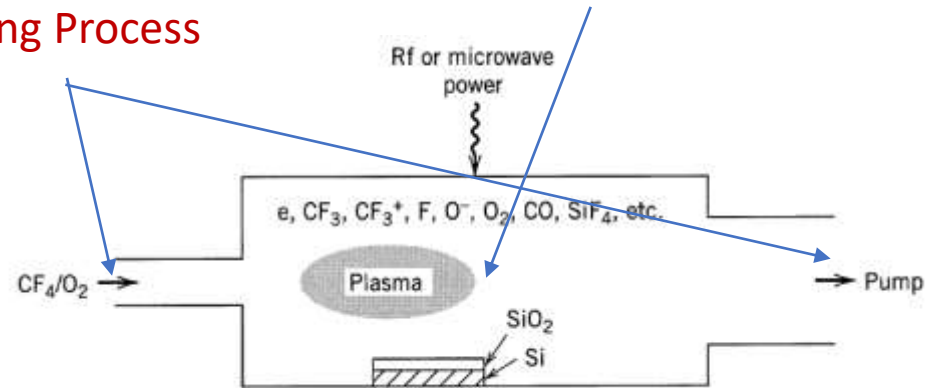
3. Principles to Plasma Surface Activation Treatment

3.3 Plasma energy for activation process (2/3)

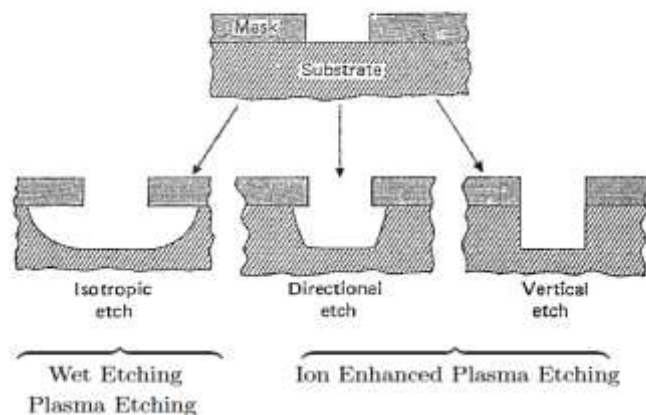
Plasma activation(or etching) Process with Toxic Gas

Cleaning Process

Etching /Activation Process



ANISOTROPIC ETCHING



ISOTROPIC PLASMA ETCHING

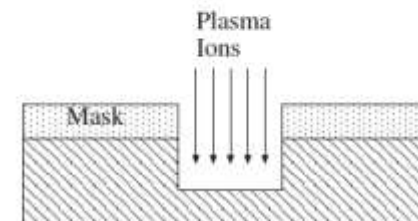
1. Start with inert molecular gas CF₄
2. Make discharge to create reactive species:
$$\text{CF}_4 \rightarrow \text{CF}_3 + \text{F}$$
3. Species reacts with material, yielding volatile product:
$$\text{Si} + 4\text{F} \rightarrow \text{SiF}_4 \uparrow$$
4. Pump away product
5. CF₄ does not react with Si; SiF₄ is volatile

Toxic Gas
(Detergent)

Evaporation molecules
(Dry process)

ANISOTROPIC PLASMA ETCHING

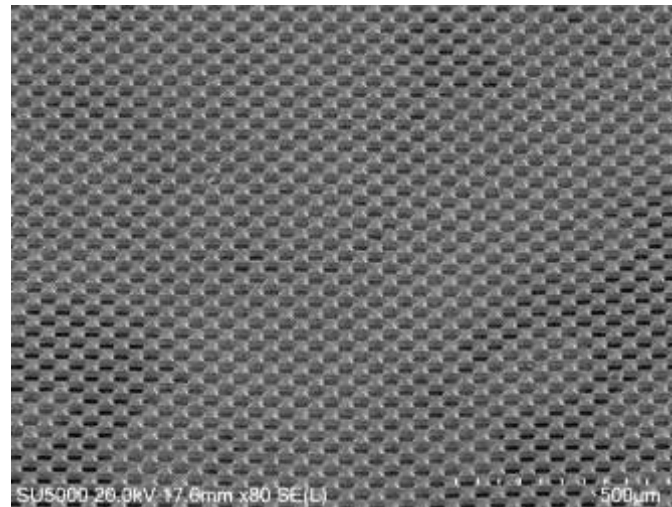
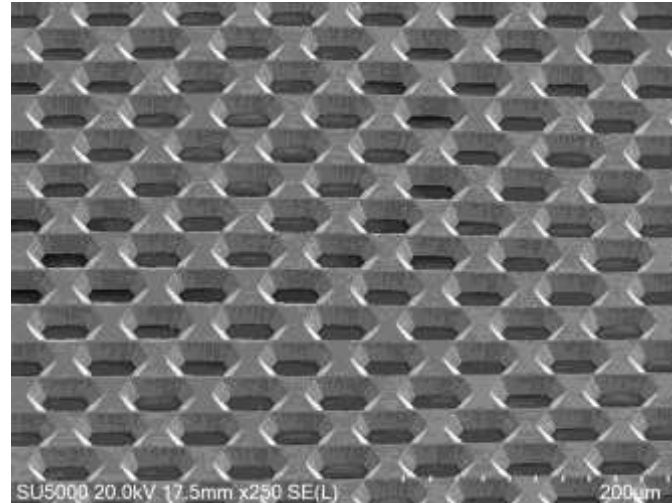
6. Energetic ions bombard trench bottom, but not sidewalls:
 - (a) Increase etching reaction rate at trench bottom
 - (b) Clear passivating films from trench bottom



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3.3 Plasma energy for activation process (3/3)

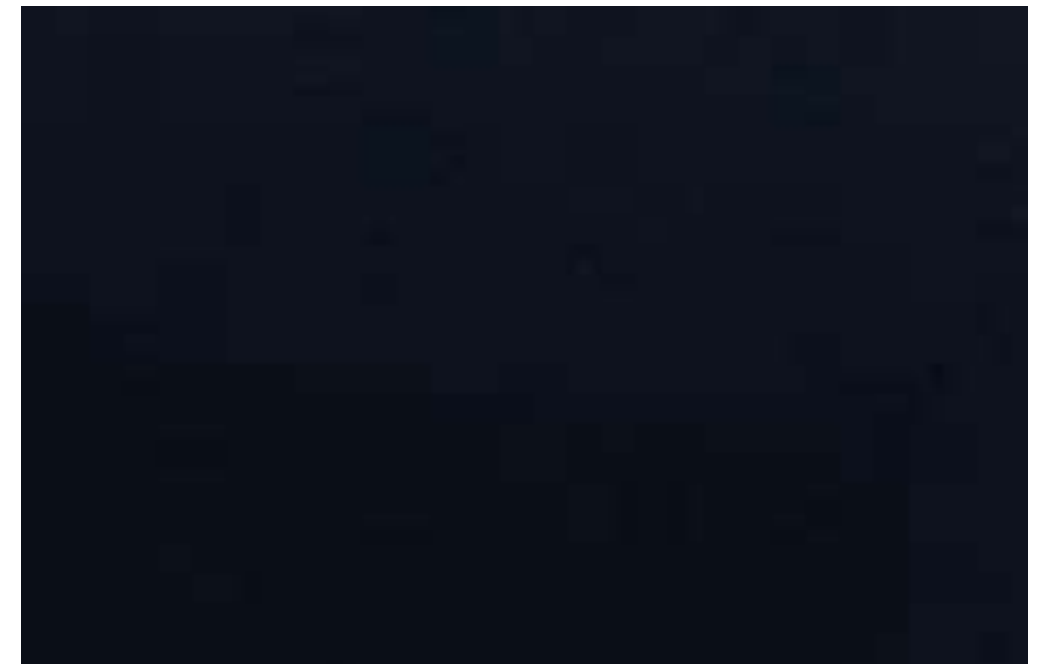
PLASMA FMM ETCHING (without CF4 Gas) 기술



PLASMA DUV 광원(4인치) 발광 기술

200nm
대면적 LED

저가화
고효율화



VOD 3-3-1