

Dry Cleaning

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DI water

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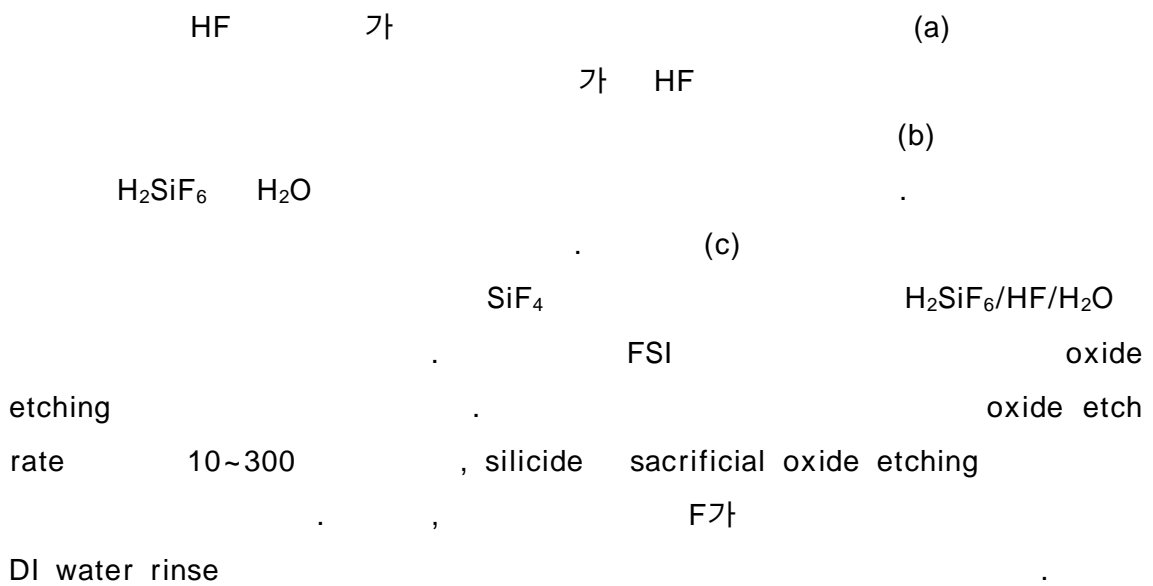
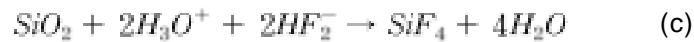
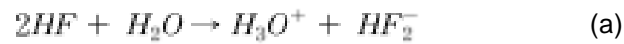
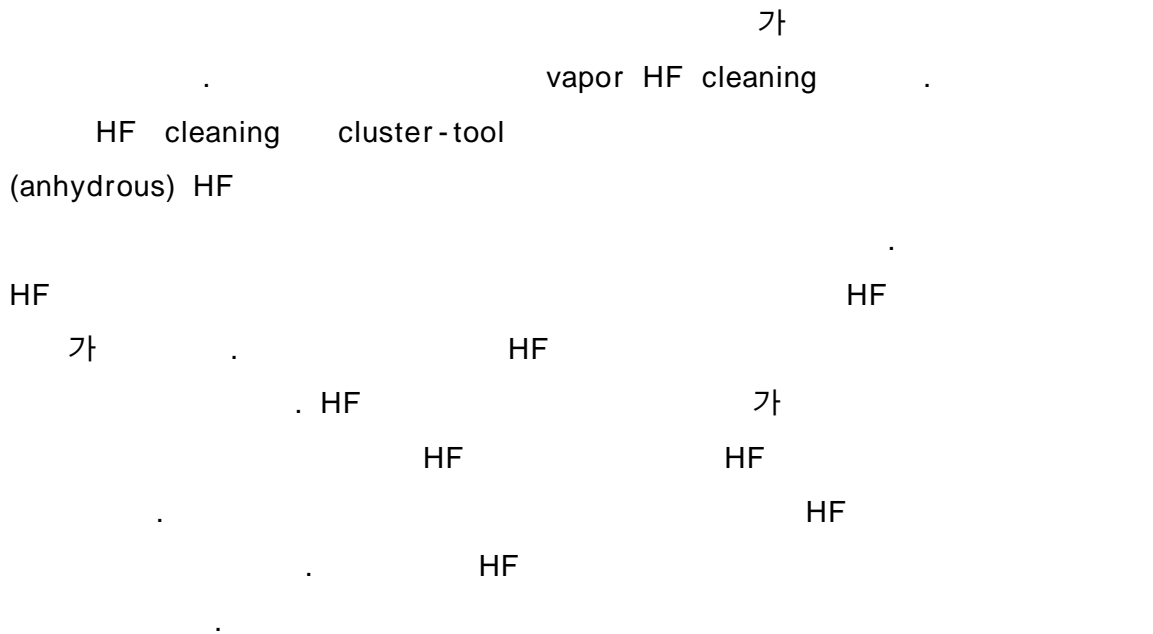
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Table. 1.

	Gross Organics	Fine Organics	Metals	Native Oxide
Vapor Phase Cleaning		· HCl : HF : H ₂ O vapor		· HF : H ₂ O vapor · HF : CH ₃ OH
UV/O ₃ & UV/Cl ₂ Cleaning	· UV/O ₃	· UV/O ₃ · UV/O ₂ H ₂ O vapor	· UV/Cl ₂	· UV/HF:CH ₃ OH · UV/NF ₃ :H ₂ :Ar
Plasma Enhanced Cleaning	· O ₂ /H ₂ direct-remote plasma	· O ₂ /H ₂ remote plasma	· HCl remote plasma	· H ₂ remote plasma · NH ₃ /H ₂ ECR plasma · NF ₃ :H ₂ remote plasma
Sputtering Cleaning				· Low energy Ar sputtering
Thermal Enhanced Cleaning	· Oxidation	· Oxidation · NO : HCl : N ₂	· HCl anneal	· H ₂ anneal · High T/UHV · Mid T/UHV · GeH ₄ : H ₂

1. Vapor phase cleaning



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2. UV/O₃ and UV/Cl₂ cleaning

UV

가 .

UV cleaning Cl₂ O₂가 polymer UV/Cl₂ UV/O₃ 가 가

UV/O₃

. UV

depolymerization

UV

H₂O, CO₂, N₂

. UV/O₃

유기오염물 + $h\nu \rightarrow$ 여기된 유기오염물 (200~300nm UV) (a)

$O_2 + h\nu \rightarrow 2O$ (184.9nm UV) (b)

$O + O_2 \rightarrow O_3$ (c)

$O_3 + h\nu \rightarrow O + O_2$ (243.7nm UV) (d)

여기된 유기오염물 + (O, O₃) \rightarrow 휘발성 화합물 (e)

(a) Hg arc lamp UV

(b)~(e) 가 ,
가

UV/O₃ . 184.9nm(O₂

) 253.7nm(O₃)

UV UV source sample 가 sample

$$I = I_0 e^{-130pd}$$

(p : average ozone pressure, d : distance to sample in cm)

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UV/O₃

Ar/F

UV/O₃

UV/Cl₂

Cl 가

가

UV

UV/Cl₂

SC-2 가

가

UV

HF/H₂O

Fig. 1

Cl₂- (radical)

(MCl_x)

Na

UV/Cl₂

UV-lamp

UV

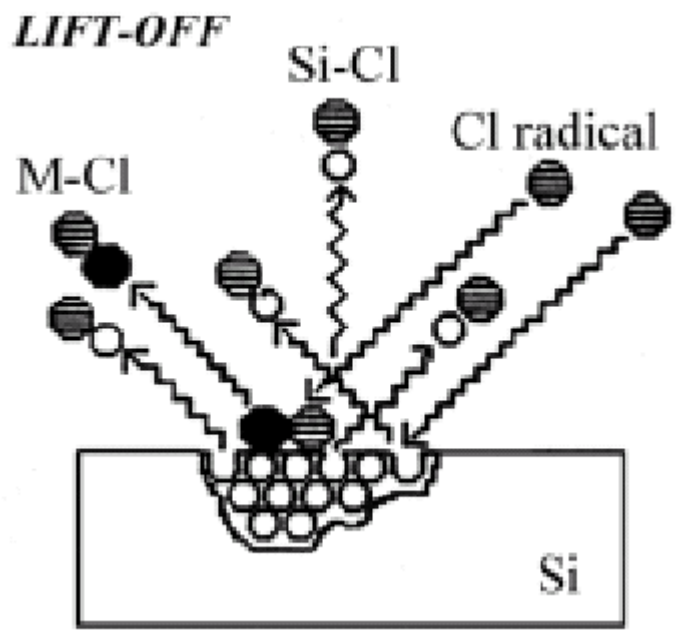


Fig. 1. Formation of metal chlorides and removal through lift-off process

3. Plasma cleaning

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Fig. 2

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Fig. 3

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가 가

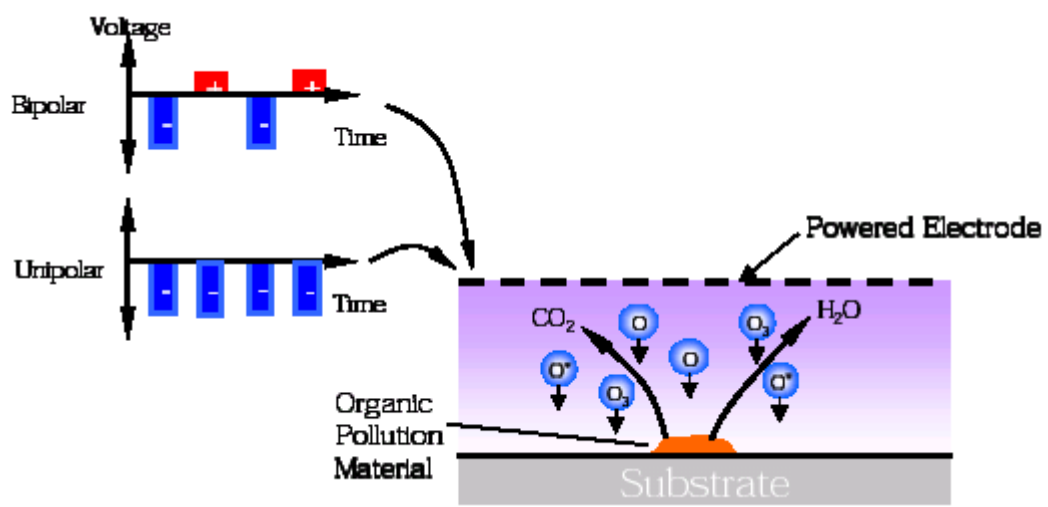


Fig. 2.

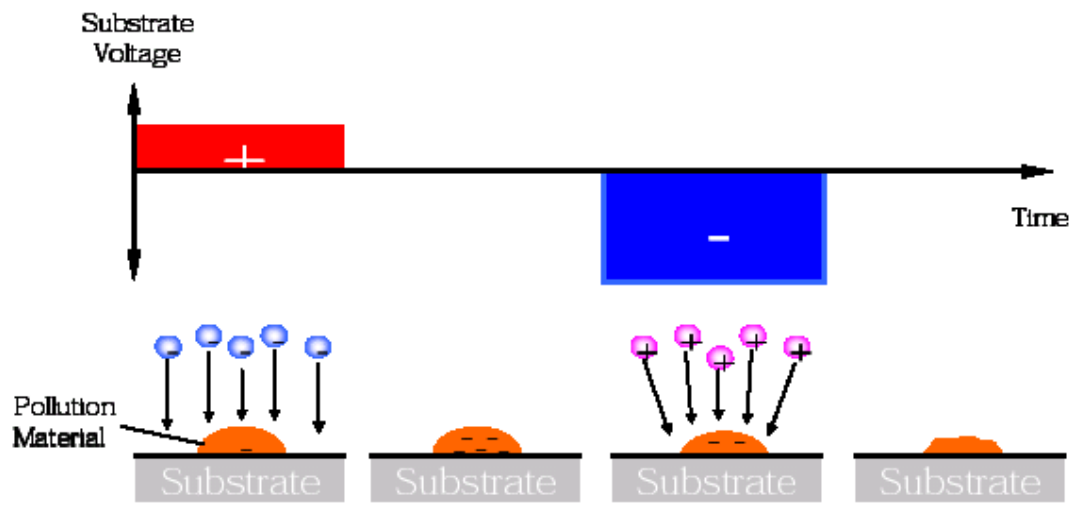


Fig. 3.

250

ECR /

$H_nSiR(n<3, R : \text{hydrocarbon})$

$SiO^*(g), H_2O^*(\text{vapor})$ SiH_n

가 CF_4 Cl_2 가 HCl

, cluster-tool

system 가

subsurface 가

Si

, 가

가

RF , , ECR , ICP

4. Sputter cleaning

Sputtering-off fig. 4 가 (momentum transfer)

, Ar heavy element low energy sputtering

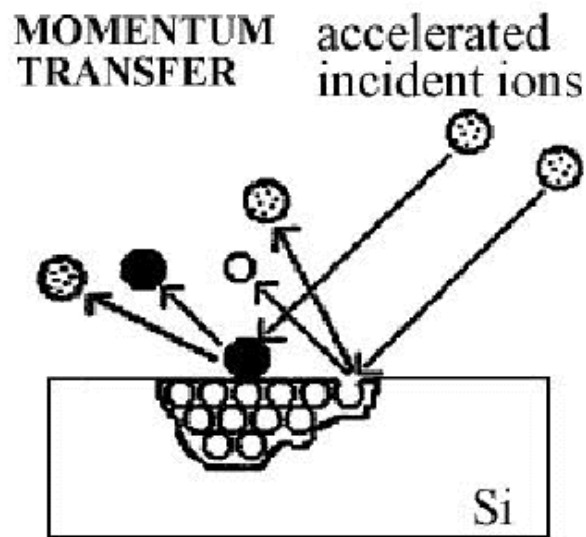


Fig. 4. via sputtering-off

5. Purely thermally enhanced cleaning

Fig. 5 가 가

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H₂ 1000 가 가 ,

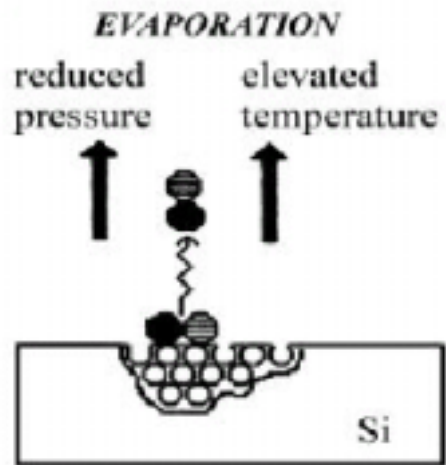


Fig. 5. evaporation of contaminants at reduced pressure and increased temperature