

1)

ULSI deep sub-micron ,
 DRAM 가 (Giga-bit) ,
 가 . ,
 , 가 ,
 가 ,
 (cleaning process) .
 400 가
 20% .
 (electrical characteristics) ,
 .

2)

1970 RCA 가 . 30
 RCA .
 가 가
 RCA bath 가
 가
 1950 1970 .
 가 가 . 1970
 RCA

- 1950 ~ 1960 :

- 1961 ~ 1971 : 가 가
가 RCA

- 1972 ~ 1989 :

- 1990 ~ : 1990 가 가 가
가 가

(ESH)

가

3)

1970
RCA H₂O₂ SC-1(Standard
cleaning-1, NH₄OH:H₂O₂:H₂O=1:1:5 to 1:2:7 at 70~80) SC-2(Standard
cleaning-2, HCl:H₂O₂:H₂O=1:1:5 to 1:2:8 at 70~80)

SC-1

()

SC-2

0.13 μ m

가
ULSI LSI VLSI 가

RCA SC-2 Piranha(H₂SO₄:H₂O₂) DHF SC-1

Piranha
H₂SO₄ 가

H₂O₂ DHF

Cu
50:1~1000:1

가
DI water

rinse가 가

가 가

가

가

SC-1

가

small geometry(contact via hole trench,)
가

ex-situ

가

(segregation)

(redistribution)

(thermal

()

mismatch) (strain) .

hole trench small
geometry .

가 cluster-tool system

cluster-tool system 가 Cluster-tool system

in-situ , , ,
HF/H₂O , UV/O₃ , UV/Cl₂

, H₂/Ar ,

가

가

가
(batch)

가 ,

4)

1

APM (Ammonium peroxide mixture) particle . SPM
(Sulfuric acid peroxide mixture) , HPM

(Hydrochloric acid peroxide mixture), FPM ()

. DHF (Diluted HF), BHF (buffered HF), H₂O₂

F

()

APM particle , 가
SPM , resist
가 .
HNO₃()

2

H₃PO₄ HNO₃ base 가 . Si₃N₄
H₃PO₄/H₂O가 , Si HNO₃/HF/H₂O, Al
H₃PO₄/HNO₃/CH₃ COOH .

Resist , , CMP know
how가 , .
Resist bulk resist . ashing

resist , wet . Al
가 , 가 가 ,
resist

etching 가 ,
F , . CMP
CMP 가 , 가 가 ,

, TMAH(Tetra Methyl Ammonium
Hydroxide) base ,
가 pattern 가 ,
가 . 가
 . IPA (Isopropyl Alcohol) , rinse .

< 1 >

APM(SC - 1)	NH ₄ OH/H ₂ O ₂ /H ₂ O	
HPM(SC - 2)	HCl/H ₂ O ₂ /H ₂ O	
SPM	H ₂ SO ₄ /H ₂ O ₂	
DHF	HF/H ₂ O	
BHF	NH ₄ F/HF/H ₂ O	,
FPM	HF/H ₂ O ₂	
	HF/O ₃ /H ₂ O	

< 2 >

Etching	N ₃ PO ₄ /H ₂ O	Si ₃ N ₄ etching
	HNO ₃ /HF/H ₂ O (/CH ₃ COOH)	Si etching
	H ₃ PO ₄ /HNO ₃ /CH ₃ COOH/H ₂ O	Al etching
Resist		Resist
		etching
CMP		,
(TMAH)	(CH ₃) ₄ NOH	positive resist
IPA	(CH ₃)CHOH	()

5)

(ITRS 2002)

Year	1999	2000	2002	2005	2008	2011	2014
Technology node	180nm		130nm	100nm	70nm	50nm	35nm
FEOL Particle Size(nm)	90	82.5	60	50	35	25	18
FEOL Particle(#/cm ²)	0.064	0.06	0.064	0.051	0.052	0.052	0.052
BEOL Particle Size(nm)	180	165	130	100	70	50	36
BEOL Particle(#/cm ²)	0.064	0.06	0.064	0.051	0.052	0.052	0.052
Surface Roughness	0.15	0.14	0.12	0.1	0.08	0.08	0.08
Critical Surface Metals('10 ⁹ atoms/cm ²)	9	7	<4.4	2.5	--	--	--
Organics('10 ¹³ atoms/cm ²)	7.3	6.6	<5.3	4.1	--	--	--

* : The International Technology Roadmap for Semiconductors, 2002