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:

(54)

Sn

EM(ElectroMigration)

1d

, EM, Sn , CuSn

1a 1d 1
2a 2d 2

102, 202 : 104, 204, : 1
106, 206 : 1 108, 208 : 2
110, 210 : 2 112, 212 :
114, 214 : 116, 216 :
118, 220 : Sn 120, 222 :
122, 224 : 220 :

EM(ElectroMigration)

(Contact hole) 가 ,
 EM(ElectroMigration) 가 ,
 EM 가 ,
 (Al) EM ,
 (Al) 가 , EM

< >
 $MTTF \propto \frac{S}{\sigma^2} \log \left(\frac{I_{(111)}}{I_{(200)}} \right)^3$
 MTTF(Mean Time To Failure) EM , S (Logno
 raml) , I₍₁₁₁₎ I₍₂₀₀₎ (111), (200) X- (Ray) . ,
 (111) , (111) EM
 (Al) (Texture degree) (, (,
 Cu) 'S.S.Wrong et al., IITC, p107, 1998' , ' (,
 Seed layer) (111) 가 (111) 가 ,

EM 가 .
 가 EM ,

EM(ElectroMigr

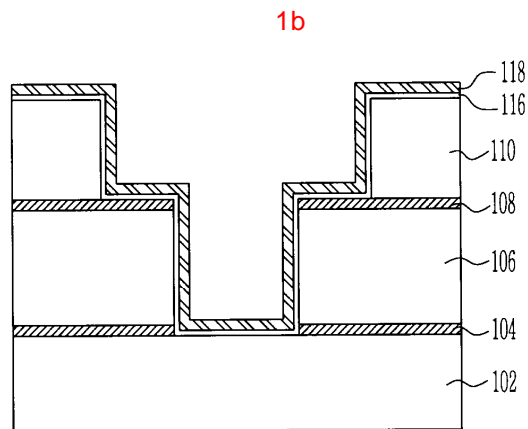
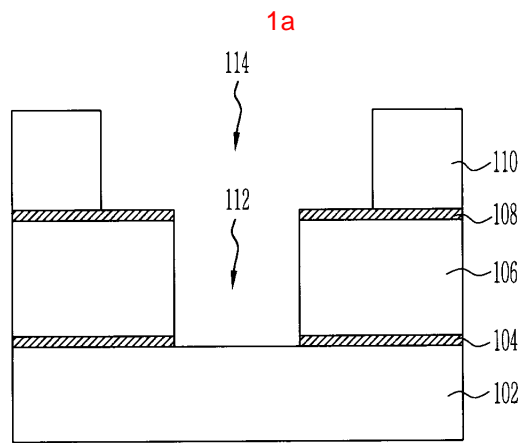
ation) ,
 (Void) (Via) .
 Sn Sn , Sn
 CuSn ,
 가 , 가
 1a 1d 1 ,
 (Via hole) (Trench) (先)
 1a , (102) (112) ,
 (Via etch stop layer)(, ' 1 ')(104) .
 , 1 (104) SiN ,
 (, ' 1 ')(106) ,

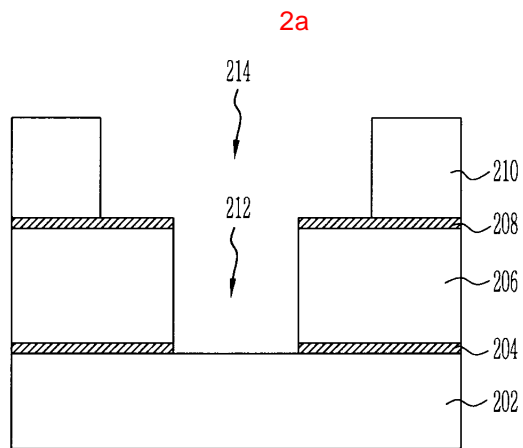
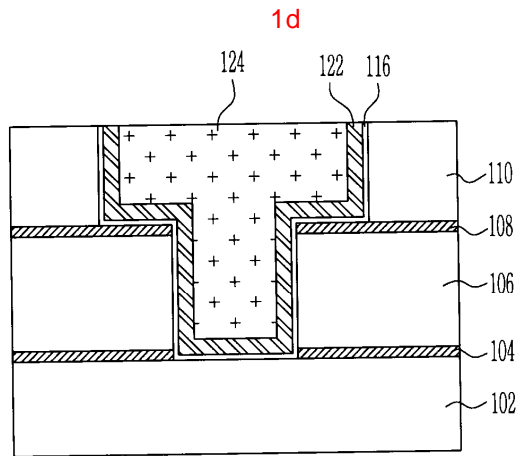
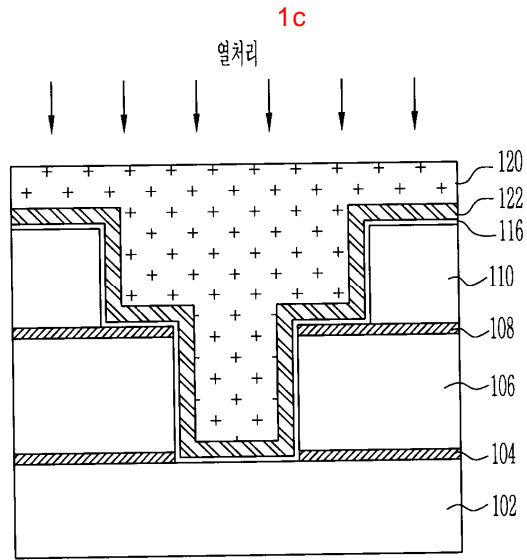
가 , 가가 .
 (Trench etch stop layer)(114) (108) 2 (108) 1
 (104) SiN .
 (, 2 ,) (110) . 2 (110) 1 (106)
 SiN () ,
 (Photoresist) (Photo mask)
 (Photoresist pattern)() ,
 1 (104) (112) ,
 (Strip) () ,
 2 (110) ()
 114) . ,
 1b (112) (114) (,)
 (116) 50 300 (116) Ta, TaN, TaAlN, TaSi₂
 , Ti, TiN, TiSiN, WN, Co CoSi₂
 (116) (Chemical Vapor Deposition; CVD) (Atomic Layer
 Deposition; ALD) Sn (118) 100 1500 . CVD , LPCVD(Low Pressure
 CVD) PECVD(Plasma Enhanced CVD) 가 , PECVD
 PECVD Sn (118) (Power)
 50 1000W
 CVD , Sn (118) SnH₄ , Sn(CH₃)₄ CH₃SnH
 3 , (CH₃)₂SnH₂ 100 500sccm (H₂) 20
 5000sccm , 0.01 100Torr , 100
 400 , Sn (118) .
 < >
 SnH₄ + 2H₂ Sn + 4H₂
 , Sn (118) (Oxidation) (120) (120) (124)(1d) E
 M
 1c (112) (114)가 (120) (120)
 (120) , (Annealing) (120)
 , Sn (118) (120) (120) (116) CuSn
 (122) , CuSn (122) 3.6 μ cm
 1d (120) (Chemical Mechanical Polishing; CMP)
 , 2 (110) (116), CuSn (122) (120)
 (124) . 가 ()가 , ,
 , .
 2
 1 (114) (, 1a) , 2
 2a 2d 2
 2a () (202) 1 (204), 1 (20
 6), 2 (208), 2 (210), (212) (214)
 1
 2b (212) (214) (,)
 (216) 50 300 (216) Ta, TaN, TaAlN, TaSi₂
 , Ti, TiN, TiSiN, WN, Co CoSi₂
 (216) (Seed layer; 218) 300 1500 ()
 218) Cu, Pt(Platinum), Pd(Palladium), Ru(Rubidium), St(Strontium), Rh(Rhadium) Co(Cobalt)
 (Cu) (218)
 (218) CVD ALD Sn (220) 50 500
 (226)(2d) 가 . CVD
 , LPCVD PECVD 가 , PECVD

7. 6 , 0.01 100Torr , 가 100 400

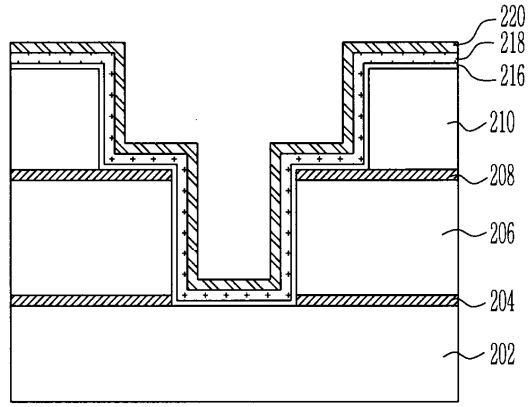
8. 1 , 50 500

9.



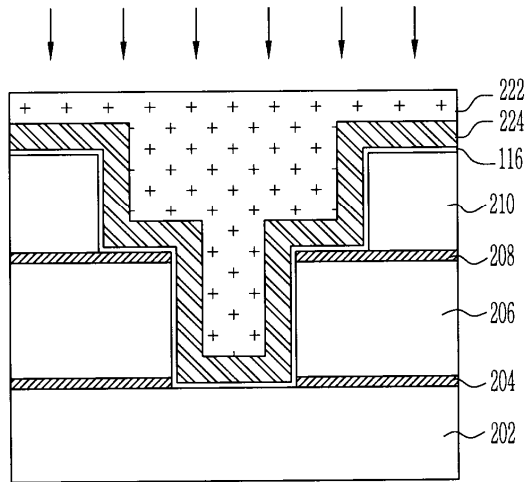


2b



2c

열처리



2d

