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(24)

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(43)

2001-0110527
2001 12 13

(73) 3 416

(72) 518 203 1103

1334 7 1113

7 1603-251/8

530 203 1302

(74)

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(54) - -

MIM(metal - insulator - metal)

MIM MIM

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MIM

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MIM) 가 가 가 (. DRAM 가 (HSG) , (fin) 가 (가 , Ta₂O₅ BST((Ba,Sr)TiO₃) 가 SiON 가 가 가 (work function)가 TiN Pt 2000-3511 Ta₂O₅ TiN TiN (TiN/Ta₂O₅/TiN) , TiN Ta₂O₅ 가 Si₃N₄ 가 (Pt/Ta₂O₅/Pt) , (step coverage) 가 가 가 가

(refractory metal,) , Ti, Ta, W TiN, TiSiN, TiAlN, TaN, TaSiN, TaAlN, WN , Ru, Pt, Ir RuO₂, PtO, IrO MIM

Ta_2O_5 , Al_2O_3 , TaON
 Si_3N_4 , Al_2O_3 , TaON, HfO_2 , ZrO_2 가
 (Atomic Layer Deposition, ALD) (Chemical Vapor Deposition, CVD)
 가
 () () () ()
 1 (planar type) 1
 1 AIN, TaN, TaSiN, TaAlN, WN (10) Ti, Ta, W (10) TiN, TiSiN, Ti
 가 CVD ALD CVD ALD ()
 (12) Ta_2O_5 , Al_2O_3 , TaON 가
 CVD ALD (14) Ru, Pt, Ir RuO₂, PtO, IrO₂
 가 (14) (12) (10) 가 CVD ALD
 (10) (20) (12) (10) (12) ZrO₂
 (20) Si_3N_4 , Al_2O_3 , TaON, HfO_2 (14)
 (12) 3 1 2 3
 1 90 UV-O₃ CVD-TiN Ta₂O₅ UV-O₃ Ta₂O₅
 3 CVD-Ru CVD-TiN Ta₂O₅ CVD-Ru Si₃N₄
 PVD(Physical Vapor Deposition, CVD-Ru) CVD-TiN ()
 TiN () ±1V
 TiN CVD-TiN (500) PVD-TiN() TiCl₄, NH₃ Ta₂O₅
 Ta₂O₅ 가 PVD-TiN () 가 CVD-

Ru_2O_3 () Ta_2O_5 (oxygen vacancy) O
 가 가), PVD-TiN
 , 가 MIM , (10)
 (14)
 4 9 가 CVD-Ru / Ta_2O_5 /CVD-TiN
 4 ()가 (100) (110)
 , (120, 140) (110)
 0, 140) (140) 가 4 130 (140) (120, 130 140)
 (140) 가 (130) (120 140)
 100) (110) (130) (110)
 , 5 (140, 120) (130) (110)
 (150) (150)
 , 6 TiN (160) CVD ALD (con
 formally) TiN (160)
 TiN (160) $TiCl_4$ NH_3 가 0.1 10 Torr 600 700 가 CV
 D ($TiCl_4$) 가 (NH_3) TiN (160) 가 가 가
 가 가 (450 550) (etch-back) (142) 6
 , 6 (142 170) (142) (170)
 , 8 TiN (162) Ta_2O_5 (180) Ru (190)
 , Ta_2O_5 (180) $Ta(OC_2H_5)_5$ Ta 가 O_2 가
 400 500 CVD , 300 ALD
 Ta_2O_5 (180) O_3 , Ta_2O_5 (180) UV-O
 3 , Ta_2O_5 (180) 700
 , Ta_2O_5 (180)
 RuO_2 가 (190) , Ru 가 , $Ru(C_2H_5C_5H_4)_2$ Ru 가 가
 250 450 CVD ALD , Ru
 , 1999 12 23
 99-61337 ,
 Ru (190) , 10 50 Torr(
 20 40 Torr) , O_2 가 500 2000 sccm(1000 1500
 sccm) 5 5 , 0.05 10 Torr(
 0.1 3 Torr) , O_2 가 10 300 sccm(50 150 sccm)
 Ru
 , 9 (162) (180) Si_3N_4 ()
 200) Si 가 NH_3 N 가 CVD TiN (162)
 , (180) (190) , Si_3N_4 (200) 600
 700 (190)
 Si_3N_4 (200) Ta_2O_5 (180) Ru (190)
 Ta_2O_5 (180) Ta_2O_5 (180)

가 (180) Ru (190) 가 Ru (190) Ta₂O₅
 10 11
 /CVD-TiN , CVD-Ru /CVD-Ta₂O₅
 10 , 11 ±1V 가 1μm, 40fF 가 C_{min}/C_{max} 150 0.99
 10⁻¹⁶ A
 가 CVD ALD가

MIM

Ru MIM CVD

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TiN ;
 TiN Si₃N₄ ;
 Ta₂O₅ ;
 CVD-Ru ;
 Si₃N₄ Ta₂O₅ ;
 CVD-Ru TiN Ta₂O₅ ;
 CVD-Ru CVD-Ru Ta₂O₅ ;
 CVD-Ru Ta₂O₅

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TiN ; ; ;
 TiN ; ; ;
 Si₃N₄ ; ; ;
 Ta₂O₅ ; ; ;
 Ru ; ; ;
 CVD-Ru ; ; ;
 Si₃N₄ ; ; ;
 TiN ; ; ;
 CVD-Ru ; ; ;
 Ta₂O₅ ; ; ;
 Ta₂O₅ ; ; ;
 Ta₂O₅ ; ; ;

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 Ta₂O₅ ; ; ;
 Ta₂O₅ ; ; ;
 UV-O₃ ; ; ;

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 Si₃N₄ ; ; ;

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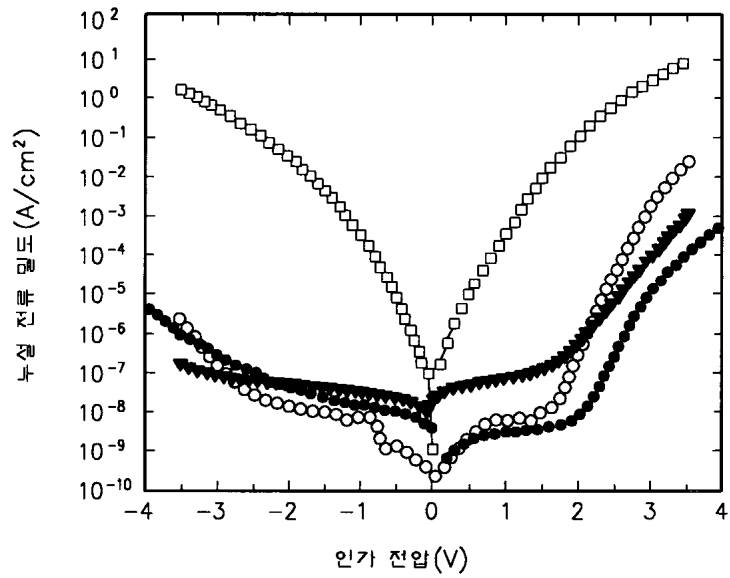
1

Ru, Pt, Ir, RuO ₂ , PtO 또는 IrO ₂	14
Ta ₂ O ₅ , Al ₂ O ₃ 또는 TaON	12
Ti, TiN, TiSiN, TiAlN, Ta, TaN, TaSiN, TaAlN, W 또는 WN	10

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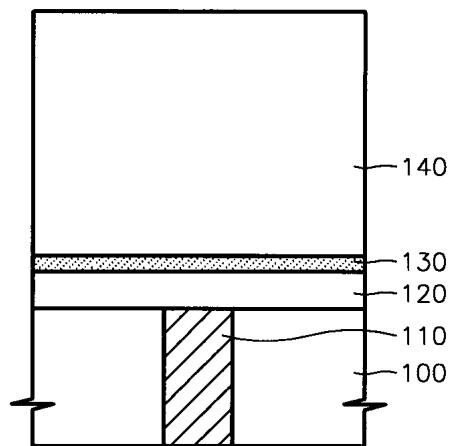
Ru, Pt, Ir, RuO ₂ , PtO 또는 IrO ₂	14
Ta ₂ O ₅ , Al ₂ O ₃ 또는 TaON	12
Si ₃ N ₄ , Al ₂ O ₃ , TaON, HfO ₂ 또는 ZrO ₂	20
Ti, TiN, TiSiN, TiAlN, Ta, TaN, TaSiN, TaAlN, W 또는 WN	10

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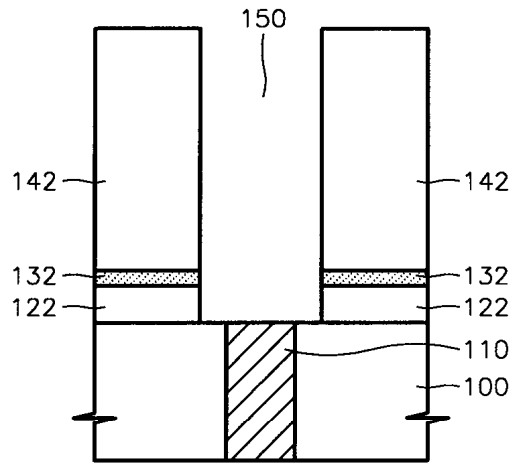


- CVD-TiN/Ta₂O₅/CVD-TiN
- PVD-TiN/Ta₂O₅/CVD-TiN
- ▼ CVD-Ru/Ta₂O₅/CVD-TiN
- CVD-Ru/Ta₂O₅/Si₃N₄/CVD-TiN

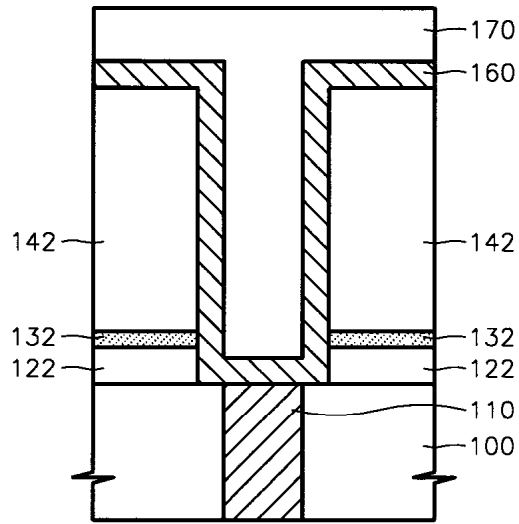
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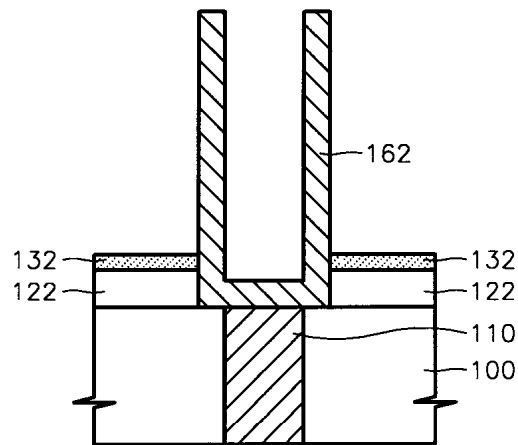
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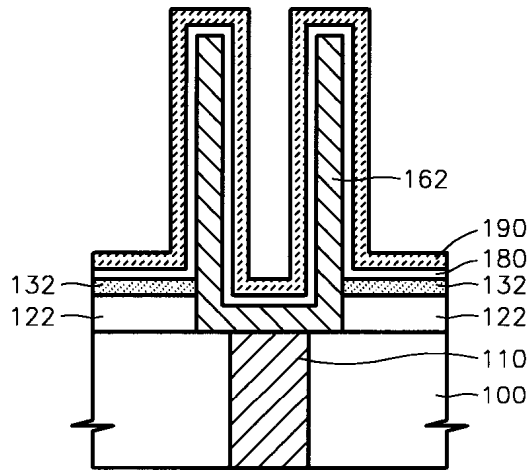
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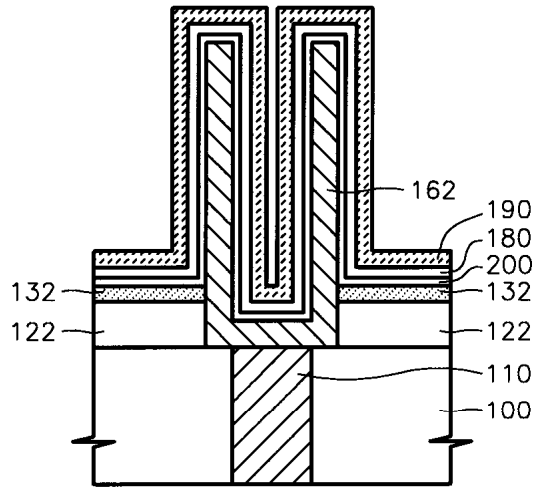
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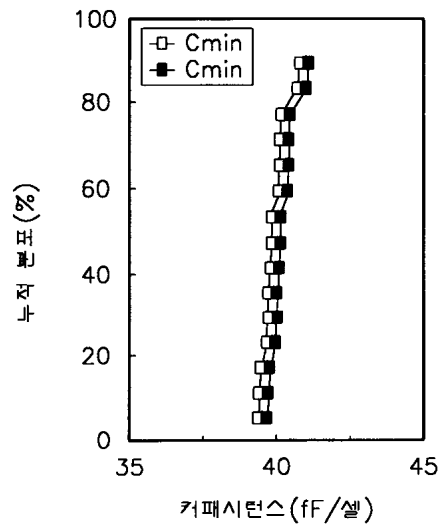
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