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10 - 0351450
2002 08 22

(21) 10 - 1999 - 0067182
(22) 1999 12 30

(65) 2001 - 0059661
(43) 2001 07 06

(73) 136 - 1

(72) 5 502 104

270 - 2

(74) ()

:

(54)

$(\text{TiO})_x\text{N}$

, ONO

,
(TaO)_{1-x} (
Ta₂O₅

4

1

2

3

(TaO)_{1-x} (TiO)_xN

4

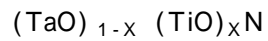
*

*

1: 5:

10: 15: HSG

20: 25:



가
 DRAM(Dynamic Random Access Memory) (volatile)
 SRAM (flash) (Non - Volatile)

가

(flash)

가 가

(floating gate)

(control gate)

control gate)

(ONO)

(P)

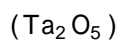
O₅)

, 256M 가

DRAM

가

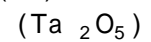
(Ta₂O₅)



(stoichiometry)

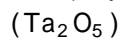
(Ta) (O)

(vacancy atom)가

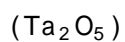


(oxygen vacancy)

(Ta) 가



(Ta)

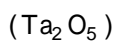
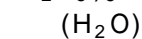
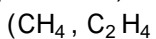


(precursor)



O₂ (N₂O) 가

(C)



(radical)

가 가

$(\text{TaO})_{1-x} (\text{TiO})_x\text{N}$ $\text{Ti}/\text{Ta}=0.01$ 1.0 가 NH_3 O_2 가 10sccm 1000
 sccm
 , (in - situ) (ex - situ)
 , , 650 950 N_2O , O_2 N_2
 ,
 1 4
 , 1 (10)
 1 (1) (5)
 (5) , (low pressure chemical vapor deposition)
 (10)
 (10) , TiN , TaN , W , WN , WSi , Ru , RuO_2 , Ir , IrO_2 Pt
 가
 (10) , (Hemi Spherical Grain; HSG)
 (15) , (10) (stack)
 가 3
 , 2
 (10,15) (in - situ) (ex - situ) (SiO_2) 가 (1
 0+15) , , 300 600 , (NH_3) 가 N_2/H_2
 1 5 (Rapid Thermal Process; RTP) (10) HSG (15)
 (nitridation) , (in - situ) (ex - situ) 650 950 N
 H_3 RTP (furnace) 500 1000 NH_3
 , (ex - situ) (HF) (in - situ)
 , HF , 가 NH_4OH
 H_2SO_4 가 RTP NH_3 N_2/H_2 ,
 300 950 , NO_2 O_2 (dangling bond)
 3 ($\text{TaO})_{1-x} (\text{TiO})_x\text{N}$ (20)
 09) (20) , ($\text{TaO})_{1-x} (\text{TiO})_x\text{N}$ (0.01 x 0.
 , (Ta) MFC(Mass Flow Controller)
 (Ta(OC_2H_5) $_5$) 140 200

(Ti) (Ti [OCH(CH₃)₂]₄)
 200 300 Ti
 (TiCl₄) TDMAT(tetrakis - dimethylamido - Ti) TDMEA
 T(tetrakis - diethylamido - Ti)
 Ti/Ta=0.01 1.0 (mole ratio) 가 (NH₃) 가
 (O₂) 가 10sccm 1000sccm
 (TaO)_{1-x} (TiO)_xN
 4 (TaO)_{1-x} (TiO)_xN (20)
 가 (furnace) 650 95
 0 N₂O(O₂ N₂) 5 30
 (TaO)_{1-x} (TiO)_xN (20) (25)
 Ir, IrO₂ Pt (25), TiN, TaN, W, WN, WSi, Ru, RuO₂,
 100 600
 (buffer layer)
 LP - CVD, PE - CVD, RF
 (25), (TaO)_{1-x} (TiO)_xN (20)
 (10,15), (20) (25)
 ()가 40 (TaO)_{1-x} (TiO)_xN
 (=4 5) Ta₂O₅ (=25)
 (TaO)_{1-x} (TiO)_xN 가 3
 가 (stack) 가
 (tetragonal system) 가 (TiO₂) (T
 a₂O₅) 가 (Ta₂O₅) 가
 (TaO)_{1-x} (TiO)_xN
 (Ta₂O₅) (level)
 (Rapid Thermal Annealing; RTA)
 가
 가 가

(57)

1.

,
;
;
, (TaO)_{1-x} (TiO)_xN ;

2.

1 , Ti Ta 가 0.01 1.0 : 1 .

3.

1 , ,

4.

1 , HSG , ,

5.

1 , .

6.

1 , TaN, W, WN, WSi, Ru, RuO₂, Ir, IrO₂ Pt .

7.

5 , ,
TiN, TaN, W, WN, WSi, Ru, RuO₂, Ir, IrO₂ Pt ,

8.

;
;
, (TaO)_{1-x} (TiO)_xN ;

;

9.

8

10.

8

11.

10

300 600 , NH₃ N₂/H₂ 1 5

12.

11

600 950 , NH₃

13.

11

500 1000 , NH₃

14.

8

15.

14

, NH₄OH H₂SO₄

16.

8 , (TaO)_{1-x} (TiO)_xN (0.01 x 0.09) Ti Ta 가 0.01 1.0 : 1

17.

8 , (TaO)_{1-x} (TiO)_xN Ta
Ta(OC₂H₅)₅ 140 200

18.

8 , (TaO)_{1-x} (TiO)_xN Ti Ti[OCH(CH₃)₂]₄
200 300

19.

8 18 , (TaO)_{1-x} (TiO)_xN Ti TiCl₄, TDMA
T, TDEAT

20.

8 , (TaO)_{1-x} (TiO)_xN Ti/Ta=0.01 1.0 가 NH₃ O₂가 10s
ccm 1000sccm

21.

8 , , ,

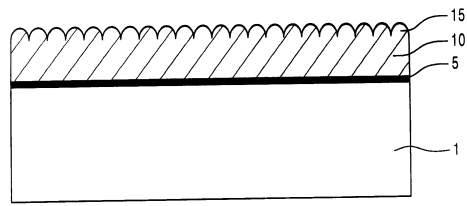
22.

21 ,

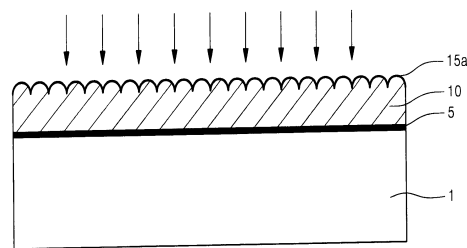
23.

21 , 650 950 N₂O, O₂ N₂

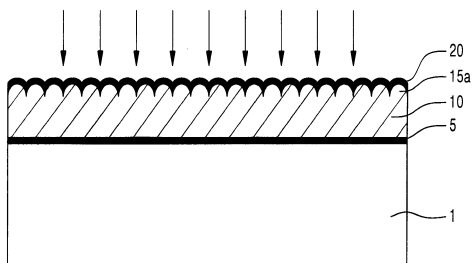
1



2



3



4

