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[Continued on next page]

(54) Title: SELECTIVE IMPLEMENTATION OF BARRIER LAYERS TO ACHIEVE THRESHOLD VOLTAGE CONTROL IN CMOS DEVICE FABRICATION WITH HIGH K DIELECTRICS

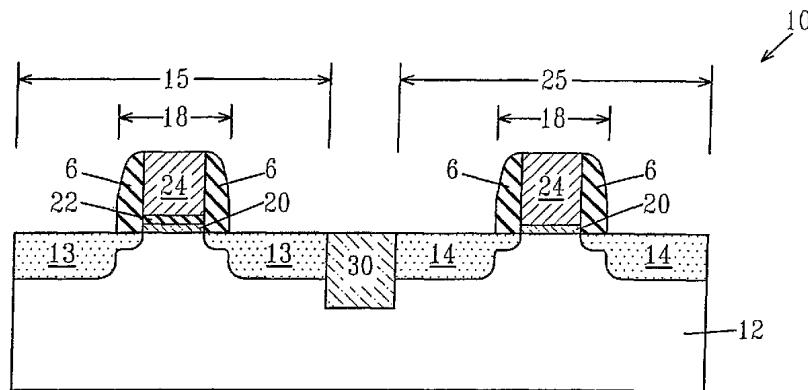


FIG. 4

(57) Abstract: A method of forming a CMOS structure, and the device produced therefrom, having improved threshold voltage and flatband voltage stability. The inventive method includes the steps of providing a semiconductor substrate having an nFET region and a pFET region; forming a dielectric stack atop the semiconductor substrate comprising an insulating interlayer atop a high k dielectric; removing the insulating interlayer from the nFET region without removing the insulating interlayer from the pFET region; and providing at least one gate stack in the pFET region and at least one gate stack in the nFET region. The insulating interlayer can be AlN or AlOxNy. The high k dielectric can be HfO2, hafnium silicate or hafnium silicon oxynitride. The insulating interlayer can be removed from the nFET region by a wet etch including a HCl/H2O2 peroxide solution.

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European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,  
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,  
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,  
GQ, GW, ML, MR, NE, SN, TD, TG).

— *as to the applicant's entitlement to claim the priority of the  
earlier application (Rule 4.17(iii))*

**Published:**

— *with international search report*

**Declarations under Rule 4.17:**

— *as to applicant's entitlement to apply for and be granted a  
patent (Rule 4.17(ii))*

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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US05/10825

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC: H01L 29/792( 2006.01)

USPC: 257/324,369,411

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 257/324,369,411

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,538,278 B1 to Chau, 25 March 2003 (25.03.2003), Fig. 2, col. 3 line 6-col. 5 line 34. US 6,407,435 B1 to Ma et al., 18 June 2002 (18.06.2002), Figs. 2-3, col. 2, lines 4-8.	1-27

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"E" earlier application or patent published on or after the international filing date

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"&" document member of the same patent family

Date of the actual completion of the international search

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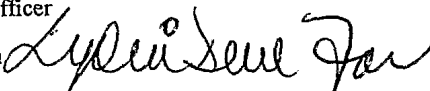
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**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation Sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.
  3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
  4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-27
- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
  - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
  - No protest accompanied the payment of additional search fees.

**BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING**

I. Claims 1-27, drawn to a semiconductor device.

II. Claims 28-54, drawn to a process of making a semiconductor device.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Inventions I and II are related as product made and process of making.