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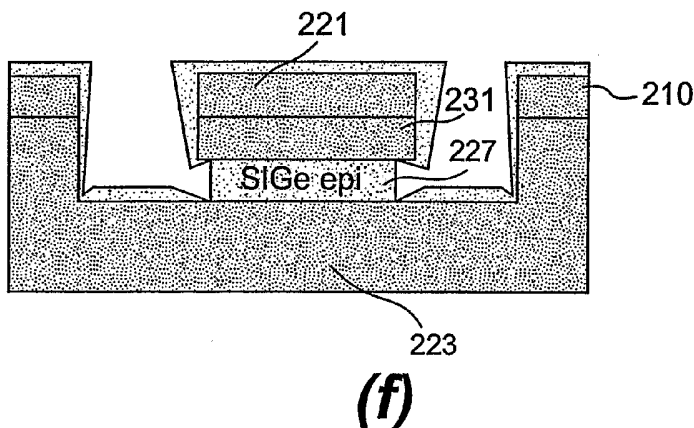
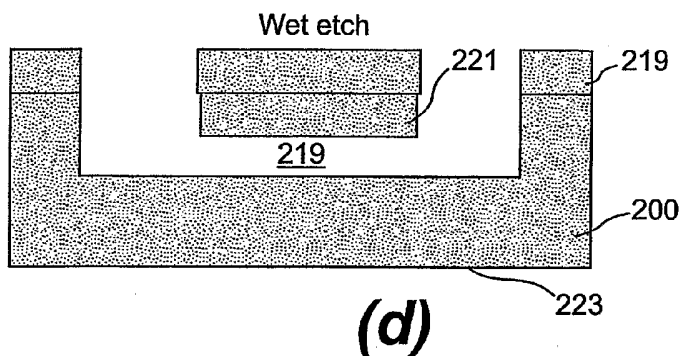
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[Continued on next page]

(54) Title: METHOD AND STRUCTURE FOR FORMING STRAINED Si FOR CMOS DEVICES



(57) Abstract: A method for manufacturing a device including an n-type device and a p-type device. In an aspect of the invention, the method involves doping a portion of a semiconductor substrate (200) and forming a gap (219) in the semiconductor substrate (200) by removing at least a portion of the doped portion of the semiconductor substrate (200). The method further involves growing a strain layer (227) in at least a portion of the gap (219) in the semiconductor substrate (200). For the n-type device, the strain layer (227) is grown on at least a portion which is substantially directly under a channel of the n-type device. For the p-type device, the strain layer is grown on at least a portion which is substantially directly under a source region or drain region of the p-type device and not substantially under a channel of the p-type device.



European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, 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).

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/37049

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01L 21/38, 21/461, 21/47, 21/8238, 29/161, 29/772
US CL : 438/199, 218, 221, 514, 739, 766; 257/65, 288

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. : 438/199, 218, 221, 514, 739, 766; 257/65, 288

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
None

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPAT; US PG PUBS; Derwent; EPO; JPO; IBM TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2002/0086472 A1 (Roberds et al.) 04 July 2002 (04.07.2002), Figs. 1-7, paragraphs [0020] to [0043].	1-2, 7, 17-18, 24-26 ----- 5-6, 8-14
X, E	US 6,825,086 B2 (Lee et al.) 30 November 2004 (30.11.2004), Figs. 1-4, 9, 11 and column 2, line 46 to column 5, line 50.	1,18-19, 23
X, E --- Y, E	US 6,891,192 B2 (Chen et al.) 10 May 2005 (10.05.2005), Figs. 3-9 and column 2, line 52 to column 7, line 10.	1, 3-4, 8-12, 15, 18, 24-33, 35-36 ----- 16
Y	US 2001/0003364 A1 (Sugawara et al.) 14 June 2001 (14.06.2001), paragraphs [0023], [0024], [0040], and [0042].	5-6, 8-14
Y, P	US 6,703,293 B2 (Tweet et al.) 09 March 2004 (09.03.2004), column 4, line 66 to column 5, line 20.	16
A	US 2003/0087492 A1 (Lee et al.) 08 May 2003 (08.05.2003), abstract.	1-36

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:		"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 03 October 2005 (03.10.2005)	Date of mailing of the international search report 17 JAN 2006
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Stephen W. Smoot Telephone No. 571-272-1698

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/37049

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.:
- 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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/37049

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This International Search Authority has found 3 inventions claimed in the International Application covered by the claims as indicated below.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-23, drawn to a process.

Group II, claims 24-36, drawn to a device.

The claims are deemed to correspond to the species listed above in the following manner:

Group I, species 1, claims 1-18 drawn to forming a gap by removing a portion of the substrate.

Group I, species 2, claims 19-23 drawn to forming a gap by removing a portion of the layer above the substrate.

The following claims are generic: none.

This International Search Authority considers that the International Application does not comply with the requirements of unity of invention (Rules 13.1, 13.2, and 13.3) for the following reason.

The inventions listed as Groups I and II and species 1 and 2 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: the forming of a strained layer in a trench is not a special technical feature because it has already been established in the art, as evidenced for example by US 2003/0087492 A1, in which a strained SiGe layer is disclosed (see abstract). Accordingly, the common feature is therefore not a special technical feature and unity is lacking.