



Our Case: HEW/SC/J100797EPPCT

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Dear Sirs,

European Patent Application No. 11851579.0
Intel Corporation
Transistors

We request further processing of the above application. We provide here our response to the search opinion. The further processing fee is being paid along with this communication.

In response to the search opinion, we enclose new and replacement pages 1 and 1a of the description and a replacement set of claims. A set of claims highlighting amendments is also enclosed.

Claim 1 has been amended to clarify that the source and drain regions are graded or layered, and comprise a boron doped germanium layer having a germanium concentration in excess of 90 atomic %.

Basis for the amendment can be found throughout the specification, for example, pages 5-6, especially page 5, lines 7-9, and page 6, lines 11-12 and 21.

It is clear that according to the invention the source/drain regions comprise a heavily doped germanium layer. More specifically, there is a germanium layer that is "pure", that is, close to 100% (ie over 90% according to the specification). This can be achieved according to embodiments either by a layered approach (eg SiGe layer topped by germanium layer) or by a graded approach (eg SiGe graded up to 90% or more Germanium). In the latter case, the overall average concentration of Germanium may be 50% or more, but it comprises a layer where the germanium concentration is over 90%.

Thus, there is basis for the amendments, and the amendments further define features of the originally claimed invention (see Guidelines H II 6.2) and so are allowable.

Referring to numbered points of the search opinion:

2. The unity objection is overcome because all claims are dependent on novel and inventive amended claim 1 (see point 3 below).

3. D1 discloses a transistor having source and drain regions of SiGe. Although the formula of SiGe in paragraph [0031] covers pure germanium, the preferred range is 10-40% germanium.

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EUROPEAN PATENT ATTORNEYS • CHARTERED PATENT ATTORNEYS • TRADE MARK ATTORNEYS

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In the specific embodiment given in paragraphs [0032] to [0035], silicon germanium is used. This is not pure germanium (see also, for example, the precursors used which are silicon sources).

Furthermore, the source and drain regions of D1 are not graded or layered. D1 does not disclose a graded or layered structure resulting in a high purity upper germanium layer, which is highly doped with boron.

Thus, the claimed invention is novel.

The invention provides a solution to the problem of how to achieve high concentrations of boron doping. The solution is provided by the high concentration germanium layer, which suppresses boron diffusion (see pages 2-4, 16 etc).

To provide compatibility with other features of the device such as the substrate, the source/drain regions are graded or layered, and may include buffer regions (see pages 2-6). For example, the boron doped germanium layer may be graded from a base level concentration compatible with the underlying substrate up to 100 atomic % (see paragraph bridging pages 5-6) or there may be graded SiGe layer or buffer with a germanium cap (see paragraph bridging pages 4-5, and first and second complete paragraphs on page 6).

As a result of the invention, boron diffusion is suppressed, whilst retaining structural integrity. D1 does not address the problem of the present invention, and does not provide a solution, and in particular, does not disclose or suggest the solution of the present invention. D1 is concerned with a completely different problem (improving transistor performance through reducing the silicide interface resistance) and has essentially been cited because of the generic representation of SiGe in paragraph [0031]. In other words, we respectfully submit that D1 has been found, interpreted and applied with the benefit of hindsight and knowledge of the invention. It would not have been obvious to the skilled person concerned with the problem addressed by the present invention even to consider D1, and he would not have found there a hint or disclosure of the claimed solution. 4, 5. Reference signs have been introduced throughout the claims. The description is consistent with the description and includes a reference to D1.

In view of all the above, we submit that the application is in order for allowance. If there are any outstanding matters, the Examiner is requested kindly to telephone the undersigned before issuing a further written communication. No deleted subject matter is abandoned. As a precaution, we request oral proceedings before any decision adverse to the applicant.

Yours faithfully



Holly Whitlock
Authorised Representative
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