THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 14

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte BOHUMIL LOJEK

Appeal No. 95-0871
Application 07/844,315[1]

ON BRIEF

Before MEISTER, STAAB, and McQUADE, Administrative Patent Judges.

McQUADE, Administrative Patent Judge.

DECISION ON APPEAL

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[1] Application for patent filed March 2, 1992.

This appeal is from the final rejection of claims 1 through 20, all of the claims pending in the application.

The invention pertains to a method for diffusing dopants into a semiconductor wafer. Claim 1 is illustrative and reads as follows:

1. A method of diffusing dopants into a semiconductor wafer comprising:

forming a dopant layer on a first surface of a diffusion source by applying a spin-on dopant to the first surface, the diffusion source having a first thermal conductivity;

positioning the diffusion source a predetermined distance from a product wafer having substantially the first thermal conductivity thereby creating a space between the dopant layer and the product wafer wherein the product wafer is smaller than the diffusion source and a first surface of the product wafer faces the dopant layer;

limiting a flow of a gas through the space to a predetermined flow rate while permitting the gas to flow across a second surface of the product wafer and across a second surface of the diffusion source;

heating the diffusion source to a predetermined temperature wherein the predetermined temperature causes dopants to diffuse from the dopant layer into the space;

maintaining the diffusion source at substantially the predetermined temperature until the diffusion source reaches thermal equilibrium;

heating the product wafer to substantially the predetermined temperature and diffusing the dopants from the space a predetermined depth into the product wafer thereby forming a doped area having a predetermined doping concentration variation across the product wafer; and

cooling the diffusion source and the product wafer at substantially equal rates.

The references relied upon by the examiner as evidence of obviousness are:

Genser 4,588,455 May 13, 1986

Kim et al., "Formation of Shallow Phosphorus Layers by Rapid Thermal Processing Using a Solid Diffusion Source," Journal of Korean Institute of Electrical Engineering, Vol. 1, No. 2, pp. 105-109, 1988 (Kim)

Claims 1 through 20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Kim in view of Genser. As explained by the examiner,

> [c]laims 1-20 are directed to a process for diffusing dopants into wafers wherein the dopant source is a silicon wafer spin coated with a coating containing the dopant. Kim et al. disclose a process substantially identical to that claimed by the applicant (page 106, figure 2), except that Kim et al. use a different dopant source.
>
> Genser discloses a dopant source comprising a silicon wafer spin coated with a coating containing the dopant (column 2, lines 60-65 and column 3, lines 62-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to

> use the dopant source of Genser in the process of Kim et al., because the dopant source of Genser is a functional equivalent of the dopant source used by Kim et al. [main answer, Paper No. 11, page 3].

The appellant does not dispute the propriety of the examiner's combination of Kim and Genser, but does contend that the combination fails to respond to many of the limitations in the appealed claims. A detailed statement of the appellant's position on appeal appears in the main and reply briefs (Paper Nos. 10 and 12).

One of the limitations argued by the appellant is that in independent claim 1 requiring the step of limiting the flow of a gas through the space between the dopant layer and the product wafer to a predetermined flow rate. Independent claims 8 and 16 contain similar limitations. The appellant's specification indicates that diffusion is typically performed while an inert gas flows between the diffusion source and the wafer and that this gas flow disturbs the migration of dopants from the former to the latter and contributes to a non-uniform doping concentration across the wafer. Limiting the flow of the gas

through the space between the dopant layer on the diffusion source and the product wafer is said to alleviate this problem.

Kim confirms the typical use of an inert gas flow during a diffusion process (see Figure 2 on page 106), but gives no detail as to the characteristics of the flow rate. The examiner submits, however, that

> Kim et al. flows nitrogen gas through their apparatus. Nitrogen is usually contained in a reservoir connected to the apparatus via a control valve. The very act of opening the valve limits the gas flow rate, and since how far the valve should be opened is generally decided beforehand, the flow rate is predetermined. As shown in figure 2 of Kim et al. the wafer tray clearly channels gas flow around the space containing the dopant source and the product wafer. This allows for less disturbance of the gas in the space in which diffusion takes place. In other words the tray also limits the gas flow rate through the space between the dopant source and the product wafer [main answer, pages 4 and 5].

The examiner's apparent position that it would have been obvious to one of ordinary skill in the art to supply the Kim apparatus with inert gas at a predetermined flow rate is reasonable. This, however, does not result in or lead to the step of limiting the flow of the gas through the space between the dopant layer and the product wafer to a predetermined flow

rate as recited in independent claims 1, 8 and 16. The examiner's contention that Kim's wafer tray would channel most of the gas flow around the space in question is unduly speculative and is based on unfounded assumptions regarding the structure of the tray and its relationship with the space. Moreover, even if the tray did function to channel gas flow away from the space between the dopant layer and the product wafer, this would still not amount, in and of itself, to a step of limiting the flow of the gas through the space to a predetermined flow rate.

In short, Kim offers no teaching, suggestion or inference of a diffusing method containing the gas flow limiting steps recited in claims 1, 8 and 16. Inasmuch as Genser fails to cure this deficiency in Kim, these references do not supply the factual basis necessary to conclude that the differences between the subject matter recited in claims 1, 8 and 16, and in claims 2 through 7, 9 through 15 and 17 through 20 which depend therefrom, and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to one having ordinary skill in the art.

Accordingly, we shall not sustain the standing 35 U.S.C. § 103 rejection of claims 1 through 20.

The decision of the examiner is reversed.

REVERSED

JAMES M. MEISTER)
Administrative Patent Judge)
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LAWRENCE J. STAAB) BOARD OF PATENT
Administrative Patent Judge) APPEALS AND
)
JOHN P. McQUADE) INTERFERENCES
Administrative Patent Judge)

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MOTOROLA, INC.
Patent Department
P.O. Box 10219
Scottsdale, AZ 85271-0219