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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/465,688	03/22/2017	Hans-Joachim Schulze	P66742US	4336

81722 7590 09/27/2019

Viering, Jentschura & Partner mbB - Inf
c/o
444 Brickell Avenue
Suite 51270
Miami, FL 33131

EXAMINER	
PARK, SAMUEL	

ART UNIT	PAPER NUMBER
2818	

NOTIFICATION DATE	DELIVERY MODE
09/27/2019	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HANS-JOACHIM SCHULZE, ANDREAS HAERTL, FRANCISCO JAVIER SANTOS RODRIGUEZ, ANDRÉ RAINER STEGNER, and DANIEL SCHLOEGL

Appeal 2018-008832
Application 15/465,688
Technology Center 2800

Before JEFFREY T. SMITH, JEFFREY B. ROBERTSON, and MERRELL C. CASHION, JR., *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1, 4–16, and 18–22, all of the pending claims. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Infineon Technologies AG. Appeal Br. 3.

According to Appellant, the following rejection is presented for our review:[2]

Claims 1, 4–16, and 18–22 rejected under 35 USC §103 as unpatentable over Zhu (US 2014/0083493 A1; Mar. 27, 2014), in view of Urena (WO 2013/020867 A1; Feb. 14, 2013), Wang (US 8,288,297 B1; Oct. 16, 2012), and Bachrach (US 2009/0077805 A1; Mar. 26, 2009).

Appellant's invention relates to a semiconductor device. (Spec. ¶ 2). Claim 1 is illustrative of the subject matter on appeal and is reproduced below:

> 1. A semiconductor device, comprising:
> a semiconductor body;
> a plurality of regions in the semiconductor body each comprising a eutectic of a first metallization material and material of the semiconductor body, wherein at least two of the plurality of regions are non-contiguous and neighboring regions separated by one or more portions of the semiconductor body; and
> a second metallization material disposed over the semiconductor body, wherein the plurality of regions comprises a first region non-contiguous to a second region

[2] As a result of the Response to Final Office Action filed February 7, 2018, which cancelled claim 3 and incorporated the limitations therein into claim 1, we understand the Examiner to have modified the rejections in the Final Office Action consistent with Appellant's discussion of the rejections in the Appeal Brief. (Advisory Action entered March 8, 2018; *see* Ans. 3 confirming that the amendment cancelling claim 3 and incorporating the limitation in claim 1 had been entered.) Further, we note that claims 13–15 were rejected under 35 U.S.C. § 103 as unpatentable over the combination of Zhu and Lin et al. (Pub. No.: US 2011/0168250 A1) (Final Act. 26). Based on the statements presented in Appellant's Brief it appears this rejection has been withdrawn. (App. Br. 8). The Examiner has not provided a specific discussion addressing this rejection and the Answer. We therefore consider this rejection to be withdrawn.

> neighboring the first region and wherein the plurality of regions are spike-shaped regions, and
>
> wherein the second metallization covers and contacts the first region, the second region, and a portion of the semiconductor body separating the first region from the second region.

OPINION[3]

We have reviewed each of Appellant's arguments for patentability. We will not sustain the Examiner's rejection for essentially those reasons expressed by Appellant. (App. Br. 9–15).

The Examiner finds Zhu discloses a semiconductor device comprising: a semiconductor body, a plurality of regions comprising a eutectic of a first metallization material and material of the semiconductor body, wherein at least two of the plurality of regions are non-contiguous and neighboring regions separated by one or more portions of the semiconductor body. (Final Act. 3; Fig. 1 & 2 and ¶¶ 15, 16, 20, and 34). The Examiner finds the areas between element Ni and element Si are NiSi contact areas in the semiconductor body, each contact area comprising a eutectic region of a first metallization material and material of the semiconductor body. (Final Act. 3–4; Fig. 1 & 2 and ¶¶ 15, 16, 20, and 34). The Examiner finds Zhu does not explicitly disclose the plurality of NiSi contact regions are spike-shaped regions. Addressing this difference the Examiner cites Urena. The Examiner states:

> Urena discloses wherein the plurality of regions are spike-shaped regions (see Fig. 1 & pg. 13 lines 27-32 & pg. 14 & pg. 15 lines 1-20 silicon semiconductor substrate body element 31, metal element 40, eutectic regions elements 34 of the metal element 40 and the silicon semiconductor substrate body formed by heating above a eutectic temperature of metal-

[3] We limit our discussion to independent claim 1.

> Si, wherein the eutectic regions elements 34 are spike-shaped-note that metal element 40 directly contacts silicon semiconductor substrate body element 31 only in certain portions elements 30 and is heated to a eutectic temperature, above 577 degrees Celcius, to form the spike-shaped eutectic metal-Si regions; also see in particular pg. 14 lines 5-21 the formation of the spike-shape is a result of aluminum in contact with silicon being heated above the eutectic temperature of 577 degrees Celcius with a (100)-oriented substrate).

(Final Act. 9–10).

The Examiner determines it would have been obvious to incorporate the spike-shape for the plurality of metal-Si eutectic regions described by Urena as the shape for the plurality of Ni Si eutectic regions of Zhu in order to provide a device having a good shielding of the metal-Si eutectic regions. (Final Act. 10).[4]

We agree with Appellant that the structural differences between the devices of Zhu and Urena would not lead or motivate one skilled in the art to combine the devices in the manner proposed by the Examiner. (App. Br. 10). Urena discloses contacting the p-type emitter 32 at the front side of the substrate 31 with a contact originating at the back side of the substrate (opposite side). (Urena pg.14, ll. 22–25). On the other hand, Zhu's p-type and n-type regions in the solar cells are accessible from the back side of the substrate (same side). (Zhu ¶ 10). Urena discloses forming a contact 34 extending through n-type substrate 31 in order to electrically contact the p-type emitter 32 at the front side. (Fig. l (d)). Urena discloses the "highly doped recrystallized regions 35 provide a good shielding of the contacts 34

[4] The Examiner cites Bachrach for describing the back contact layer that contains a metal layer selected from a group consisting of zinc (Zn), tin (Sn), aluminum (Al), copper (Cu), silver (Ag), nickel (Ni) and vanadium (V). (Final Act. 12; Bachrach ¶ 77 Fig. 3).

from minority carriers." (Urena pg.14, l. 31–pg. 15, l. 15). Thus, Urena's highly doped recrystallized regions 35 and not the triangular or "spike-shaped" regions provide the benefits of good shielding. Consequently, the Examiner has not provided adequate reasoning why one skilled in the art would have incorporated contacts designed to contact a front side from a back side into Zhu's invention.

We also agree with Appellant that Bachrach only discloses a back contact can use metals such as nickel or aluminum. (App. Br. 14). The Examiner has not adequately explained why aluminum and nickel would react similarly in all respects and equally lead to the formation of triangular shaped regions. We further agree with Appellant that the Examiner has not pointed to evidence that the nickel-silicon contact of Zhu would have been able to form spike -shaped regions as required by the claimed invention. (App. Br. 14–15).

For the reasons above, we do not sustain the Examiner's rejection of independent claim 1.

DECISION

The Examiner's rejection is reversed.

DECISION SUMMARY

Claims Rejected	**Basis**	**Affirmed**	**Reversed**
1, 4–16, and 18–22	§ 103 Zhu, Urena and Bachrach		1, 4–16, and 18–22
Overall Outcome			1, 4–16, and 18–22

REVERSED