

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte QI XIANG, BOON-YONG ANG,
and JUNG-SUK GOO

Appeal 2008-0952
Application 10/643,461
Technology Center 2800

Decided: September 24, 2008

Before KENNETH W. HAIRSTON, MAHSHID D. SAADAT,
and KARL D. EASTHOM, *Administrative Patent Judges*.

SAADAT, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1-3, 6, 7, 9, 10, 13, 15, 16, and 19. Claims 4, 5, 8, 11, 12, 14, 17, and 18 have been canceled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

STATEMENT OF THE CASE

Appellants invented a field effect transistor (FET) having increased carrier mobility based on a difference between the coefficient of thermal expansion of the gate electrode and the gate dielectric. An understanding of the invention can be derived from a reading of independent claim 1, which is reproduced as follows:

1. A FET situated over a substrate, said FET comprising:
 - a channel situated in said substrate;
 - a first gate dielectric situated over said channel, said first gate dielectric having a first coefficient of thermal expansion;
 - a first gate electrode situated over said first gate dielectric, said first gate electrode having a second coefficient of thermal expansion;wherein said first gate dielectric and said first gate electrode are selected such that a difference between said second coefficient of thermal expansion and said first coefficient of thermal expansion causes an increase in carrier mobility in said FET.

The Examiner relies on the following prior art references:

Kubo	US 6,190,975 B1	Feb. 20, 2001
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The rejections as presented by the Examiner are as follows:

Claims 1, 2, 3, 6, 9, 10, 15, and 16 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Kubo.

Claims 7, 13, and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kubo.

We make reference to the Brief (filed Sep. 1, 2006) and Answer (mailed Nov. 8, 2006) for the arguments provided by Appellants and the

Examiner and their respective details. Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but did not make in the Brief have not been considered and are deemed waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

ISSUES

1. Under 35 U.S.C § 102(b), with respect to the appealed claims 1, 2, 3, 6, 9, 10, 15, and 16, does Kubo anticipate the claimed subject matter by teaching all of the claimed limitations?
2. Under 35 U.S.C § 103(a), with respect to the appealed claims 7, 13, and 19, would the ordinarily skilled artisan have found it obvious to modify Kubo to render the claimed invention unpatentable?

PRINCIPLES OF LAW

1. Anticipation

In rejecting claims under 35 U.S.C. § 102, a single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation. *Perricone v. Medicis Pharmaceutical Corp.*, 432 F.3d 1368, 1375-76, 77 (Fed. Cir. 2005), citing *Minn. Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992). *Also See In re Paulsen*, 30 F.3d 1475, 1478-79 (Fed. Cir. 1994). Anticipation of a claim requires a finding that the claim at issue reads on a prior art reference. *Atlas Powder Co. v. IRECO, Inc.*, 190 F.3d 1342, 1346 (Fed. Cir. 1999) (quoting *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 781 (Fed. Cir. 1985)).

It is well settled that if a prior art device inherently possesses the capability of functioning in the manner claimed; anticipation exists regardless of whether there was recognition that it could be used to perform the claimed function. *See, e.g., In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997).

2. *Obviousness*

The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art. *See In re Kahn*, 441 F.3d 977, 987-988 (Fed. Cir. 2006), *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991) and *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). The initial burden of establishing reasons for unpatentability rests on the examiner. *In re Oetiker*, 977 F.2d 1443, 1446 (Fed. Cir. 1992).

The Examiner can satisfy this burden by showing some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *KSR Int'l. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (*citing In re Kahn*, 441 F.3d at 988 (Fed. Cir. 2006)).

ANALYSIS

1. *35 U.S.C. § 102(b) Rejection*

Appellants argue that Kubo does not anticipate the claims since Kubo does not mention coefficient of thermal expansion (CTE) and how it affects carrier mobility in the channel region (Br. 9). Appellants assert that the Examiner's reliance on the discussion of CTE by the Wolf¹ reference is an indication that such teachings are missing in Kubo and the claims cannot be

¹ Stanley Wolf et al. (Wolf), "*Silicon Processing for the VLSI Era, Volume 1: Process Technology*," Lattice Press, 1986, pp. 199, 647.

anticipated by Kubo (*id.*). With respect to Kubo, Appellants are of the opinion that if the SiGeC layer 14n and the Si layer 13n have lattice mismatch, the SiGeC layer is prone to have defects that impede electron flow and carrier mobility (*id.*). Appellants further assert that, according to Kubo, SiGeC layer 14n has higher electron mobility than the Si layer whereas Kubo provides no discussion of coefficient of thermal expansion (Br. 9-10).

The Examiner responds by stating that Wolf was provided to demonstrate that the coefficient of thermal expansion depends on the material and to show that the gate dielectric 19 and the gate electrode 18 of Kubo (Figure 1) have different coefficients of thermal expansion since they are formed of different materials (Ans. 6). Additionally, the Examiner characterizes the phrase “causes an increase in carrier mobility in the FET” as functional language and points out that using different materials in the FET structure of Kubo naturally causes an increase in carrier mobility due to using different materials with different coefficients of thermal expansion (*id.*).

Initially, we observe that claim 1 does not recite any specific relationship or degree of difference between the coefficient of thermal expansion of the two materials used as the gate and the gate dielectric. The claim merely requires that the coefficients be such that a difference between them causes an increase in carrier mobility. Appellants’ Specification similarly attributes the increased carrier mobility to the strain induced in the channel region and states that the difference between the coefficient of thermal expansion of the gate electrode and the gate insulation, in terms of one being higher than the other, creates tensile or compressive stress in the

channel region (Spec. 7:7-17). As such, we agree with the Examiner's interpretation that the presence of any two materials having different coefficients would satisfy the claim requirement since strain is created and carrier mobility increases as long as the coefficients are unequal.

We also find persuasive the Examiner's assertion that in order to have a difference between the coefficients of thermal expansion, the gate electrode and the gate dielectric merely need to be made of different materials (Ans. 6). In that regard, we agree with the Examiner that the coefficient of thermal expansion of each material is unique to that material and defines an intrinsic property of the material, which means that Kubo need not mention "a coefficient of thermal expansion" for each of the gate dielectric layer 19n and the gate electrode 18n to have a coefficient of thermal expansion. In other words, by the virtue of using different materials for the gate and the gate dielectric, Kubo's FET has different coefficients, which must cause an increase in carrier mobility. (See Kubo, col. 12, ll. 62-66).

Appellants' arguments (Br. 10) regarding the propriety of the anticipation rejection and whether the Examiner has properly relied on Wolf do not persuade us of error in the Examiner's rejection. Even without Wolf, given the breadth of claim 1, we find that the Examiner has properly characterized the coefficient of thermal expansion as an intrinsic property of each material. Similarly, the Examiner has properly concluded that the only structural features required by the last clause of claim 1 is a gate electrode and a gate dielectric with different coefficients of thermal expansion, which is taught by Kubo as layers 18n and 19n made of different materials. Thus, consistent with Appellants' disclosure which attributes the increased carrier

mobility to the induced strain in the channel, mere selection of two different materials results in a FET having the claimed features.

Appellants rely on the same arguments presented with respect to claim 1 to support patentability of independent claims 9 and 15 as well as dependent claims 2, 3, 6, 10, and 16 (Br. 11). Based on the same reasons discussed above, we sustain the 35 U.S.C. § 102(b) rejection of claims 1-3, 6, 9, 10, 15, and 16 as being anticipated by Kubo.

2. 35 U.S.C. § 103(a) Rejection

Appellants argue patentability of claims 7, 13, and 19 by relying on the same arguments made with respect to claim 1, which we found to be unpersuasive. Therefore, for the reasons discussed above, we sustain the 35 U.S.C. § 103(a) rejection of claims 7, 13, and 19 over Kubo.

CONCLUSION

On the record before us, Appellants have failed to show that the Examiner has erred in rejecting claims 1-3, 6, 7, 9, 10, 13, 15, 16, and 19. We sustain the 35 U.S.C. § 102(b) rejection of claims 1-3, 6, 9, 10, 15, and 16 and the 35 U.S.C. § 103(a) rejection of claims 7, 13, and 19 over Kubo.

ORDER

The decision of the Examiner rejecting the claims is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

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AFFIRMED

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