

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(2) is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte WILLIAM UEI-CHUNG LIU  
and DARRELL G. HILL

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Appeal No. 96-4103  
Application 08/363,479<sup>1</sup>

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ON BRIEF

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Before JERRY SMITH, BARRETT, and HECKER, Administrative Patent Judges.

JERRY SMITH, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal under 35 U.S.C. § 134

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<sup>1</sup> Application for patent filed December 23, 1994. According to appellants, this application is a Division of Application 08/159,758, filed November 30, 1993, now Patent No. 5,389,554, issued February 14, 1995; which is a continuation of Application 08/032,779, filed March 16, 1993 (abandoned); which is a continuation of Application 07/856,106, filed March 23, 1992 (abandoned).

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from the examiner's final rejection of claims 1-12<sup>2</sup> and 21-24, which constitute all the claims remaining in the application.

The disclosed invention pertains to an emitter structure of a heterojunction bipolar transistor (HBT). Such transistors typically have an emitter layer of AlGaAs adjacent to a base layer of GaAs. The invention specifically is directed to an emitter layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  wherein  $x > 0.5$ . This value of  $x$  is said to improve the operation of a HBT by permitting the emitter layer to act as a ballast resistor as well as the active emitter for the transistor.

Representative claim 1 is reproduced as follows:

1. An emitter structure for a bipolar transistor, said structure comprising an emitter layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$ , where  $x > 0.5$ , adjacent a base layer whereby said emitter layer acts as a ballast resistor and as the active emitter for said transistor.

The examiner relies on the following references:

Yokoyama et al. (Yokoyama '724)	4,617,724	Oct. 21, 1986
Ohshima	4,924,283	May 08, 1990
Shimura	5,212,103	May 18, 1993
		(filed Sep. 20, 1991)
Yokoyama (Japanese Kokai)	62-036861	Feb. 17, 1987

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<sup>2</sup> Neither the final rejection nor the examiner's answer gives the basis for rejecting claim 9.

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Kusano et al. (Kusano)  
(European Application)

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June 05, 1991

The following rejections have been made against the claims on appeal:

1. Claims 1 and 4-7 stand rejected under 35 U.S.C. § 103 as being unpatentable over the teachings of Yokoyama.

2. Claims 2, 21, 22 and 24 stand rejected under 35 U.S.C.

§ 103 as being unpatentable over the teachings of Yokoyama in view of Ohshima.

3. Claim 23 stands rejected under 35 U.S.C. § 103 as being unpatentable over the teachings of Yokoyama in view of Ohshima and further in view of Kusano.

4. Claims 3, 5-8 and 11 stand rejected under 35 U.S.C. § 103 as being unpatentable over the teachings of Yokoyama in view of Kusano.

5. Claim 10 stands rejected under 35 U.S.C. § 103 as being unpatentable over the teachings of Yokoyama in view of Kusano and further in view of Shimura.

6. Claims 11 and 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over the teachings of Yokoyama in view of Yokoyama '724.

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Rather than repeat the arguments of appellants or the examiner, we make reference to the brief and the answer for the respective details thereof.

#### OPINION

We have carefully considered the subject matter on appeal, the rejections advanced by the examiner and the evidence of obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, the appellants' arguments set forth in the brief along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would not have suggested to one of ordinary skill in the art the obviousness of the invention as set forth in claims 1-12 and 21-24. Accordingly, we reverse.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine,

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837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).  
In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825

(1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984).

These showings by the examiner are an essential part of complying

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with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

With respect to independent claims 1 and 5, the examiner notes that Yokoyama teaches an emitter structure for a bipolar transistor in which the emitter layer is made of  $\text{Al}_{0.5}\text{Ga}_{0.5}\text{As}$ . The examiner observes that the only difference between Yokoyama and claims 1 and 5 is that the claims recite that  $x > 0.5$  whereas  $x = 0.5$  in Yokoyama [answer, page 4]. The examiner concludes that the  $x$  in Yokoyama could obviously be approximately 0.5 so that it would have been obvious to have a value slightly larger than the disclosed value of 0.5.

Appellants respond that there is no overlap between Yokoyama's  $x = 0.5$  and the claimed  $x > 0.5$ , and there is no suggestion in Yokoyama to use any  $x$  other than  $x = 0.5$  as used therein. Appellants also point out that their larger mole

fraction of aluminum solves disclosed problems of emitter collapse and negative differential resistance (NDR) which are problems totally unrecognized by Yokoyama. Absent the

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recognition of the advantages achieved by increasing the aluminum mole fraction, appellants argue that there is no motivation to increase the mole fraction of 0.5 as taught by Yokoyama [brief, pages 5-6].

The examiner admits that there is no overlap between the claimed range ( $x > 0.5$ ) and the prior art range ( $x = 0.5$ ). Nevertheless, the examiner insists that  $x$  is only approximately 0.5 due to the imprecision of the manufacturing process [answer, page 10]. Presumably, the examiner is asserting that the aluminum mole fraction in Yokoyama may be greater than 0.5 because of manufacturing imprecision.

The examiner's position is untenable because it is based on the position that when a prior art document teaches a value of 0.5, it really means approximately 0.5. There is nothing within the four corners of Yokoyama to suggest that any aluminum mole fraction other than 0.5 was intended or desired. The only suggestion for increasing the mole fraction above 0.5 comes from appellants' disclosure in which the advantages achieved are set forth. If the artisan did not have appellants' disclosure before

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him and had to rely strictly on the disclosure of Yokoyama, we can find no motivation for the artisan to deliberately change the disclosed mole fraction values in Yokoyama in the claimed manner.

The examiner's requirement for a showing of criticality or unexpected results is misplaced here because there is no overlap between the claimed range and the prior art range. Appellants are not under a burden to prove anything until the examiner has established a prima facie case of the obviousness of the claimed invention. Without a suggestion in the applied prior art that increasing the aluminum mole fraction above 0.5 would be desirable, there is no motivation to make the claimed modification. The examiner must find support for the modification someplace besides appellants' own disclosure. Such support is lacking here.

We also note that the examiner cannot properly find obviousness by asserting that manufacturing imperfections may have led to the overlap of the claimed invention with a prior art device. The completely unintended production of a Yokoyama device having an aluminum mole fraction greater than 0.5 would not lead the artisan to deliberately seek to produce this result. To find obviousness within the meaning of 35

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U.S.C. § 103, the artisan must be aware of the modifications that need to be made.

For all the reasons discussed above, we agree with appellants that the invention of claims 1 and 5 is not rendered obvious by the teachings of Yokoyama taken alone. Therefore, we do not sustain the rejection of independent claims 1 and 5. We note that dependent claims 2-4 and 6-12 all include the limitations of independent claims 1 or 5. None of the other applied prior art references as cited in the answer teaches an emitter layer of a transistor being made from AlGaAs in which the aluminum mole fraction exceeds 0.5. Therefore, neither Ohshima, Kusano, Shimura nor Yokoyama '724 overcomes the deficiency discussed above in the primary Yokoyama reference. Thus, we do not sustain the rejection of any of claims 1-12.

Independent claim 21 differs from claims 1 and 5 in that it recites that the emitter structure comprises a ballast resistor layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  where  $x > 0.4$  and an active emitter layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  where  $x \neq 0.4$  adjacent a base layer. In rejecting claim 21, the examiner adds Ohshima to Yokoyama as teaching an  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  graded layer between the base layer and

the emitter layer. The examiner asserts that it would have been obvious to add Ohshima's graded layer to Yokoyama's transistor to improve the cut-off frequency of the bipolar transistor [answer, page 5].

Appellants argue that neither Yokoyama nor Ohshima even remotely suggests the structure of a ballast resistor layer and an active emitter layer as recited in claim 21. The examiner responds that the ballast resistor layer is met by Yokoyama's layer 14 of  $\text{Al}_{0.5}\text{Ga}_{0.5}\text{As}$ , and the active emitter layer is met by Ohshima's graded layer (wherein  $x=0$  to  $0.3$ ) when added to Yokoyama's transistor as discussed above [answer, page 13].

Although neither Yokoyama nor Ohshima discloses that an  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  layer should operate as both a ballast resistor and an active emitter layer, we note that claim 21 merely recites two such  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  layers with each layer having a different range of the value of  $x$ . We also note that appellants' own disclosure basically indicates that the dual functions of ballast resistor and active emitter result entirely from the selection of a larger aluminum mole fraction for the  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  layer. Thus, regardless of whether either

Yokoyama or Ohshima recognized the dual functions of ballast resistor and active emitter, the claimed two layers of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  are clearly suggested by Yokoyama's layer of  $\text{Al}_{0.5}\text{Ga}_{0.5}\text{As}$  modified with Ohshima's graded layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  between the emitter layer and the base layer.

The examiner's analysis goes somewhat awry, however, when she indicates that the graded layer has a value of  $x$  ranging from 0 to 0.3. While this is true for the graded layer of Ohshima, these values are dictated by the emitter layer in Ohshima which is made of  $\text{Al}_{0.3}\text{Ga}_{0.7}\text{As}$ . In other words, the mole fraction of aluminum at the boundary between the graded layer and the emitter layer is selected to be the same at the boundary. Therefore, if a graded layer were added to Yokoyama's transistor as proposed by the examiner, the graded layer would range from a value of  $x=0.5$  at the emitter layer boundary to a value of  $x=0$  at the base layer boundary.

Thus, if Yokoyama's transistor is provided with a graded layer as taught by Ohshima, the graded layer would have an aluminum mole fraction which is greater than 0.4 near the emitter layer but would be less than 0.4 near the base layer. The recitation of claim 21 would be met by a portion of the graded layer but would not be met by all of the graded layer.

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We construe the recitation in claim 21 of "an active emitter layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$ , where  $x \neq 0.4$ " to require that the layer satisfy the condition for  $x$  throughout the layer. Since the graded layer of Ohshima when added to Yokoyama's transistor would have a value of 0.5 at the emitter boundary, we find that the active emitter layer as recited in claim 21 is not anticipated by the graded layer of a modified Yokoyama-Ohshima transistor as asserted by the examiner. Since the examiner has not addressed the obviousness of limiting the aluminum mole fraction of the graded layer of the modified Yokoyama transistor to be less than or equal to 0.4, the examiner has not established a prima facie case of the obviousness of the limitation as recited in independent claim 21.

For the reasons just discussed, we do not sustain the examiner's rejection of independent claim 21 based on the teachings of Yokoyama and Ohshima. Therefore, we also do not sustain the rejection of claims 22-24 which depend therefrom.

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In summary, we have not sustained any of the examiner's rejections of the claims. Therefore, the decision of the examiner rejecting claims 1-12 and 21-24 is reversed.

REVERSED

	JERRY SMITH	)	
	Administrative Patent Judge	)	
		)	
		)	
		)	
	LEE E. BARRETT	)	BOARD OF
PATENT	Administrative Patent Judge	)	APPEALS AND
		)	INTERFERENCES
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		)	
	STUART N. HECKER	)	
	Administrative Patent Judge	)	

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