

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* DONGSHENG MAO, RICHARD FINK,  
and ZVI YANIV

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Appeal 2008-3493  
Application 11/174,853  
Technology Center 1700

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Decided: July 30, 2008

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Before CHARLES F. WARREN, JEFFREY T. SMITH, and  
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 1-11. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

INTRODUCTION

Appellants claim a method of patterning nanoparticle field emitters comprising, in relevant part, depositing a uniform layer of nanoparticle material (140, 150) over the entire surface of a structure on which to pattern

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nanoparticle field emitters (110, 120, 130), and removing the nanoparticle layer (140) from undesired regions of said surface of the structure using physical methods (claim 1; Figures 1C and 1D).

Claims 1 and 11 are illustrative:

1. A method of patterning nanoparticle field emitters, comprising the steps of:

providing a structure on which to pattern the nanoparticle field emitters;

depositing a uniform layer of nanoparticle material over the entire surface of said structure; and

removing said layer of nanoparticle material from undesired regions of said surface of said structure using physical methods.

11. A method of patterning nanoparticle field emitters, comprising:

depositing a substantially uniform layer of nanoparticle material over an entire surface of a structure to be used as an active portion for field emission; and

removing said layer of nanoparticle material from selected regions of said surface.

The Examiner relies on the following prior art references as evidence of unpatentability:

Chang	6,436,221 B1	Aug. 20, 2002
Tsuboi	6,616,495 B1	Sep. 9, 2003

The rejection as presented by the Examiner is as follows:

1. Claims 1-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chang in view of Tsuboi.

Appellants separately argue independent claims 1 and 11. Accordingly, we address Appellants' arguments with regard to the rejection with respect to claims 1 and 11 only. 37 C.F.R. § 41.37(c)(1)(vii) (2006).

## OPINION

Appellants argue that there is no reasonable expectation that using Chang's screen printing would successfully form the pattern of nanoparticle field emitters because of disadvantages associated with screen printing as disclosed by Appellants on page 2 of the Specification, and the Examiner has not provided any objective evidence to support the determination that there is a reasonable expectation of success (Br. 3). Appellants contend that using screen printing would not permit depositing the layer over the entire surface as claimed (i.e., the claims preclude using screen printing) (Br. 3). Appellants further contend that using Tsuboi's mask is not a structure on which to pattern the nanoparticle field emitters, such that removing a layer of nanoparticle material from undesired regions of the surface of the structure is different than depositing the nanoparticle material onto a mask which is then removed (Br. 4).

Regarding claim 11, Appellants argue that the recitation that a "layer of nanoparticle material is deposited over an entire surface of a structure to be used as an active portion for field emission" precludes using Tsuboi's method that uses a mask because a mask is not used as an active portion for field emission (Br. 4).

We have considered Appellants' arguments and are unpersuaded for the reasons below.

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Based on Appellants' arguments, the primary issue in this appeal regards the breadth of the scope of Appellants' claims. Specifically, the issue is whether Appellants' method claims preclude the use of Tsuboi's mask or Chang's screen printing process. We agree with the Examiner that Appellants' claims are not so limited.

During examination claim terms are given their broadest reasonable interpretation consistent with the Specification. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). The Patent and Trademark Office applies to the claim terms the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicants' Specification. *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). The transitional language "comprising" means that the claim includes the recited features and may also include any additional features; the claim is open-ended. *In re Crish*, 393 F.3d 1253, 1257 (Fed. Cir. 2004).

In the present case, Appellants' claims 1 and 11 use the open-ended transitional claim language "comprising." Accordingly, to satisfy Appellants' claims the prior art must contain what is recited in the claim, but may also contain additional features. *Crish*, 393 F.3d at 1257.

Chang discloses a method of improving the efficiency of carbon nanotube field emitters by using a taping film (Chang, col. 1, ll. 7-10). Chang further discloses forming a carbon nanotube (CNT) (i.e., field emitter) layer in the device by screen-printing a CNT paste through a mesh pattern screen to form CNT image pixel array layer (Chang, col. 2, ll. 56-

58). An adhesive film is used after soft baking or after sintering the CNT layer to remove badly bonded CNT portions and to vertically pull up a portion of the CNT that originally laid down on the surface (Chang, col. 2, ll. 64-67; col. 3, ll. 1-2).

Tsuboi discloses a method of forming carbon nanotube films and a field emission electron source using the carbon nanotube films (Tsuboi, col. 1, ll. 7-10). Tsuboi discloses forming carbon nanotube films by using adhesive tape 24 or a mask 33 to cover the portions of the substrate surface that are not to be coated and then applying a uniform carbon nanotube coating over the surface of the substrate and the mask or adhesive tape (Tsuboi, col. 4, ll. 32-57; col. 5, ll. 1-25).

Plainly, Chang and Tsuboi disclose placing a mask (i.e., the mask or adhesive tape in Tsuboi and the screen printing apparatus in Chang, which contains a mask to form the pixel array pattern) over a surface of the structure and depositing the carbon nanotube layer to form the pattern of carbon nanotube field emitters. After depositing the carbon nanotube layer over the entire surface of the structure, which includes the mask and exposed portions of the surface, the mask is lifted to remove the carbon nanotube layer from the undesired regions of the surface (i.e., those regions covered by the mask) while leaving the field emitter portions (i.e., the active portions) on the unmasked portions of the surface. Accordingly, Appellants' claims 1 and 11 features are satisfied by Chang and Tsuboi.

Appellants appear to argue that the claims require the uniform layer of nanoparticle material be deposited directly on and over the entire surface of the structure. However, the claims do not require such direct deposition. Rather, the open-ended "comprising" language reasonably includes placing a

mask (Tsuboi) or screen printing (mask and screen) over the structure and then depositing a uniform layer of nanoparticle material over the entire surface, which includes the mask and the exposed areas of the structure's surface. In other words, the claims do not exclude using a mask or screen-printing technique to form the nanoparticle field emitters.

Moreover, we are unpersuaded by Appellants' argument with regard to claims 1 and 11 that a mask is not a structure on which to pattern nanoparticle field emitters as required by the claims (i.e., not an "entire surface of the structure to be used as an active portion for field emission" as recited in claim 11). According to the Examiner, the structure is the glass substrate in Chang or the conductive substrate 23, 31 in Tsuboi (i.e., the masking layer is placed on substrate 23, 31) (Ans. 3 and 4). It is on the glass substrate or conductive substrate that the nanoparticle field emitters are formed via the open areas of the mask, not on the mask itself. Stated differently, the exposed areas of the substrate form the "active portion for field emission" as recited in claim 11, not the masked portion as argued by Appellants, such that the claim 11 recitation "depositing . . . over an entire surface of a structure to be used as an active portion for field emission" is satisfied by Chang and Tsuboi. Accordingly, Appellants' argument that the mask is the substrate is without persuasive merit.

Furthermore, we are not persuaded by Appellants' argument that Chang's screen printing would not permit depositing the CNT layer over the entire surface as claimed for two reasons. First, as noted above, the open-ended claim language does not preclude having a screen printing apparatus with a mask over the structure on which the nanoparticle material layer is applied. Second, Appellants' Specification indicates that screen printing

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methods may be used to deposit the CNT layer (Spec. 6). Accordingly, Appellants' disclosure recognizes that screen printing methods constitute a way to deposit the CNT material layer over the entire surface of the structure. Appellants' disclosure appears to undermine their argument.

Contrary to Appellants' arguments, we determine that there is a reasonable expectation that using a screen printing method to form the patterned nanoparticle layer would have been successful. First, the disadvantages that Appellants' point to in the background of the Specification (i.e., deflection of the patterned mesh screen) merely indicate that the deposition is more difficult, not impossible (Spec. 2). In other words, there is a reasonable expectation that the screen printing method would successfully deposit the patterned nanoparticle layer, but one using it may encounter difficulty.

Second, Appellants contend that the Examiner has not relied on any objective evidence to support the determination that there is a reasonable expectation of success in using Chang's screen printing method to deposit a uniform nanoparticle layer. However, the Examiner is relying on objective evidence: Chang's disclosure. Specifically, Chang discloses forming a patterned carbon nanotube (CNT) material layer using screen printing. Furthermore, as noted above, Appellants' Specification indicates that screen printing may be used to form the nanoparticle layer. This further supports the Examiner's determination that there is a reasonable expectation that using screen printing to form the nanoparticle layer would have been successful.

For the foregoing reasons, we sustain the Examiner's § 103 rejection of claims 1-11 over Chang in view of Tsuboi.

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DECISION

The Examiner's decision 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).

AFFIRMED

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