UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SUDHIR GONDHALEKAR, TOM K. CHO,
ROLF GUENTHER, STEVE H. KIM, MEHRDAD MOSHFEGH,
SHIGERU TAKEHIRO, THOMAS KRING,
and TETSUYA ISHIWAKA[1]

Appeal 2007-1228
Application 10/150,458
Technology Center 1700

Decided: August 21, 2007

Before FRED E. McKELVEY, *Senior Administrative Patent Judge*, and JAMESON LEE and SALLY GARDNER LANE, *Administrative Patent Judges*.

PER CURIAM.

DECISION ON APPEAL

STATEMENT OF CASE

Sudhir Gondhalekar, Tom K. Cho, Rolf Guenther, Steve H. Kim, Mehrdad Moshfegh, Shigeru Takehiro, Thomas Kring, and Tetsuya Ishiwaka (hereinafter "Applied Materials") appeal under 35 U.S.C. § 134(a)

---

[1] The real party in interest is Applied Materials, Inc. (Appeal Brief, page 1).

(2006) from a final rejection of claims 1-9. Examiner's Answer entered September 7, 2006.

Claims 10-21 are appear in the application on appeal, but have been withdrawn from further consideration as being drawn to non-elected species. Office Action entered October 10, 2003, page 2; Appeal Brief filed June 23, 2006, page 2.

The application on appeal has been published as U.S. Patent Application Publication 2003/0213434 A1 (20 November 2003).

We have jurisdiction under 35 U.S.C. § 6(b) (2006).

As a result of a requirement for an election of species, Applied Materials elected to prosecute the species shown as Fig. 5 in the drawings of the application on appeal.

While claim 1-9 read on the elected embodiment of Fig. 5, claim 6 is limited to the Fig. 5 embodiment.

With reference to Fig. 1 and Fig. 5 of the drawings, claim 1 reads as follows [bracketed material added]:

> An apparatus for processing semiconductor substrates, the apparatus comprising:
>
> [1] a chamber [Fig. 1; element **1]** defining a plasma processing region [Fig. 1, element **16**] therein, the chamber including a bottom, a side wall, and a dome [Fig. 1, element **14]** disposed on top of the side wall, the dome having a substantially flat dome top;
>
> [2] a top RF coil [Fig. 5, element **102**] disposed above the dome top, the top RF coil having an outer loop which is larger in size than the substrates to be processed in the chamber;

[3] a cold plate [Fig. 5, element **134**] disposed above the top RF coil [Fig. 5, element **102**] , the cold plate being larger in size than the substrates to be processed in the chamber; and

[4] an RF insulator [Fig. 5, element **105**] disposed between the top RF coil [Fig. 5, element **102**] and the cold plate [Fig. 5, element **134**] , the RF insulator [Fig. 5, element **105**] having a heater [Fig. 5, element **131** shown as coils] disposed therein.

Claim 6 reads:

The apparatus of claim 1 further comprising an RF insulator [Fig. 5, element **130**] disposed between the top RF coil [Fig. 5, element **102**] and the cold plate [Fig. 5, element **134**] and having a heater [Fig. 5, element **131** shown as coils] integrated therein.

Claim 9 reads:

The apparatus of claim 6 further comprising a conducting plate [Fig. 5, element **132**] disposed between the RF insulator [Fig. 5, element **130**] and the cold plate [Fig. 5, element **134**], the conducting plate [Fig. 5, element **132**] including graphite.

The Examiner rejected claims 1-9 under 35 U.S.C. § 103(a) as being unpatentable over various combinations of prior art. Examiner's Answer entered September 7, 2006, page 3-14.

The prior art relied upon by the Examiner in rejecting the claims on appeal is (the reader should know that et al is not used in this opinion):

Collins (Collins 1)	EP 0 838 843 A2	Apr. 29, 1998
Imahashi	US 5,695,564	Dec. 9, 1997
Tomoyasu	US 5,900,103	May 4, 1999

Collins (Collins 2)	US 6,074,512	Jun. 13, 2000
Maydan	US 6,109,206	Aug. 29, 2000
Maeda	US 5,858,100	Jan. 12, 1999
Niori	US 5,280,156	Jan. 18, 1994

First rejection: The Examiner rejected claims 1-2, 5 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Imahashi or Tomoyasu. Answer, pages 4-5.

Second rejection: The Examiner rejected claims 3-4 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Imahashi or Tomoyasu, further in view of Collins 2. Answer 6.

Third rejection: The Examiner rejected claims 3-4 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Imahashi or Tomoyasu, further in view of Maydan and Collins 2. Answer 6-7.

Fourth rejection: The Examiner rejected claims 6 and 8 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Imahashi or Tomoyasu, further in view of Maeda or Niori. Answer 8.

Fifth rejection: The Examiner rejected claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Imahashi or Tomoyasu, further in view of Maydan. Answer 8-9.

Sixth rejection: The Examiner also rejected claims 1-2 and 5-6 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Niori. Answer, page 9-10.

Seventh rejection: The Examiner rejected claims 3-4 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Niori, further in view of Collins 2. Answer 11-12.

Eighth rejection: The Examiner rejected claims 7-8 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Niori, further in view of Imahashi or Tomoyasu. Answer 12-13.

Ninth rejection: The Examiner rejected claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Collins 1 in view of Niori, further in view of Maydan. Answer 13-14.

The Examiner's fundamental position is that although Collins 1 does not teach an RF insulating layer having a heater integrated therein, as shown in the Fig. 5 elected species, the prior art as a whole would have led of one of ordinary skill in the art to modify the RF insulating layer of Collins 1 to include such a heater layer.

Tomayasu, Imahashi, and Niori which disclose insulating layers having heaters disposed therein are said by the Examiner to make up the difference between the Fig. 5 embodiment and the claims. Answer 4-5 and 10.

Applied Materials, on the other hand, contends that the claimed subject matter would not have been obvious over the combined teachings of the prior art references because the references that disclose a heater embedded within an insulating layer all relate to heating a wafer and have no relation to RF insulation in ceiling heating mechanisms. Appeal Brief, pages 4-9; Reply Brief, page 2.

ISSUE

Has Applied Materials shown that the Examiner erred in holding that it would have been obvious to modify the heater layer of the chamber reactor of Collins 1 to have an RF insulator with a heater integrated therein as shown in Fig. 5.

FINDINGS OF FACT

On October 10, 2003, the Examiner required an election of species from one of the following embodiments: (1) species A directed to the embodiment of Fig. 5; (2) species B directed to the embodiment of Fig. 7; (3) species C directed to the embodiment of Fig. 9; and (4) species D directed to the embodiment of Fig. 10.

Applicants elected to prosecute species A (Fig. 5), indicating that claims 1-9 were readable thereon.

Species A (shown below in a reproduced Fig. 5) shows a heat conduction stack **110** comprising (1) a cooling plate **134** [referred to as a "cold plate" in the claims], (2) a conduction plate **132** [referred to as a "conducing plate" in the claims], (3) an insulator block [referred to as an RF insulator in the claims], which can be made of aluminum nitride **130** and having heater coils **131** [referred to in the claims as a heater] integrated therein, (4) an RF top coil **102** [referred to as a top RF coil in the claims] and (6) a heat transfer sheet **136** [not claimed]. Specification at 9-10.

Fig. 5 is reproduced below

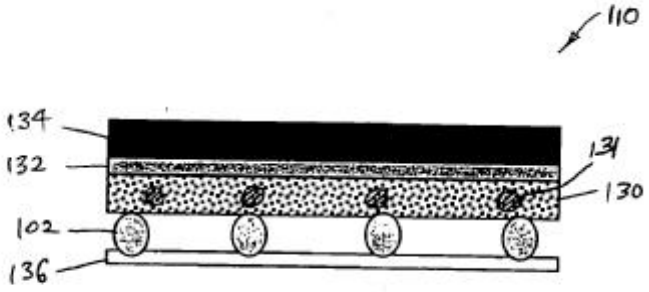

FIG. 5

Fig. 5 shows a conduction stack

Collins 1 differs from Applied Materials' Fig. 5 embodiment in that Collins 1 does not describe "an RF insulator disposed between the top RF coil and the cold plate, the RF insulator having a heater integrated therein".

Collins 1, Tomoyasu, Imahashi, and Niori disclose wafer heating devices where a coil or heat generating resistance is embedded within a material.

For example, Tomoyasu discloses a heater **306**[2] made by inserting a conductive resistance heating unit into an insulating sintered body made of aluminum nitride for use in a suscepter **305** used to heat a treated substrate **W** (wafer). Tomoyasu, col. 10:44-50.

Imahashi discloses a heating means **76** made of "a conductive resisting heat generating body… inserted in an insulating sintered body of, *e.g.* aluminum nitride" for hearing the surface of a wafer Imahashi, col. 11:20-31.

Niori discloses a wafer heating device **1** with a heat generating resistive element **3** embedded within a ceramic substrate **2**. Niori, Col. 4:11-17.

ANALYSIS

As a result of the requirement for election, examination was limited to the species (or embodiment) of Fig. 5. Consistent with our holding in *Ex parte Ohsaka*, 2 USPQ2d 1460 (Bd. Pat. App. & Int. 1987), we limit our consideration to the Fig. 5 embodiment, recognizing that additional examination of the non-elected species will follow. During that examination, the Examiner may find art applicable not only to the non-

[2] We were unable to find reference number "306" within figure 8 of Tomoyasu but understand the heater to be within the susceptor **305**.

elected species, but also the generic claims and potentially the currently elected embodiment.

Our consideration and discussion focuses only on the elected species.

Collins 1 describes a plasma reactor used for processing a semiconductor wafer and an inductive coil antenna coupling RF power through one of the parallel plates into the interior of the reactor. Collins 1, col. 1:3-8.

Collins 1 also describes an arrangement of the plasma reactor comprising: ceiling **1020** to serve as the top of a processing region **1035**; a coil inductor **1040** enclosed by an insulating layer **1112** disposed on top of ceiling **1020**; a heater layer **1110** on top of an insulating layer **1112;** and a cold plate **1120** on top of the heater layer **1110**. Collins 1, col. 37:22-30.

Collins 1 further describes a heater layer **1110** that contains a conventional electrical heating element. Collins 1, col. 37:30-32.

The elected species call for an RF insulator **130** to be disposed between the top RF coil **102** and the cold plate **134**, and has a heater **131** integrated within the RF insulator layer. Figure 5; Appeal Brief 2. The disclosure of Collins 1 that heater layer **1110** has a conventional electrical heating element would suggest that Collins 1 discloses a coil similar to the heater coils **131** of Fig. 5 of the Applied Materials' Specification. However, Collins 1 describes the heater coils to be disposed within the heater layer **1110**, and <u>not</u> within the RF insulating layer **1112** as required by the elected species. In addition, insofar as we can tell, Collins 1 does not say that heater layer **1110** can function as an RF insulator. As a result, Collins 1 does not teach that the heater coils be embedded within the RF insulator layer as required by the elected species of the claimed invention.

The Examiner suggests that the combination of Collins 1 with the teachings of Tomoyasu or Imahashi would have led one of ordinary skill in the art to use the element of the heater coils embedded within the RF insulator. Answer 4-5.

It is true that Tomoyasu describes a plasma treatment device that includes a heater **306** made by inserting a conductive resistance heating unit into an insulating sintered body made of aluminum nitride for use in a suscepter **305** used to heat a wafer. Tomoyasu, col. 10:44-50. It is also true that Imahashi describes a heating means **76** made of "a conductive resisting heat generating body… inserted in an insulating sintered body of, *e.g.*, aluminum nitride" used to heat a wafer. Imahashi, col. 11:20-25. Lastly, we can agree that Niori describes a wafer heating device **1** with a heat generating resistive element **3** embedded within a ceramic substrate **2**. Niori, 4:11-17.

While Tomoyasu and Imahashi each disclose heating elements disposed within aluminum nitride, the aluminum nitride is not being used as an RF insulating layer for the ceiling of the chamber. The devices taught by Tomoyasu and Imahashi are both utilized for heating a wafer within the chamber, which is an entirely different purpose when compared to what Collins 1 seeks to accomplish with layer **1110** or **1112**. In particular, the RF insulating layer of Collins is disposed above the ceiling, *i.e.*, outside of the chamber area where the substrate is heated, and is said to aid in maintaining a particular temperature of the ceiling to prevent polymer deposition. Collins 1, 37:20-22.

As in Tomoyasu and Imahashi, Niori teaches a heating element disposed within a material (ceramic) to be used for heating the wafer itself and not within an RF insulating layer to be used outside of the chamber area

where the wafer is processed. If these references are to be combined at all, it would appear that the elements within the Collins 1 chamber would have been modified and not the RF insulator **1112** found in the ceiling of the Collins 1 chamber.

A lawfully sufficient basis for combining the teachings of references has not been articulated. On this record, we have been unable to find a sufficient reason why one skilled in the art would have put a heating element within the RF insulator layer of Collins 1. The prior art relied upon to date does not show putting a heating element into an RF insulator layer of a temperature control system disposed above the ceiling of the chamber. Collins 1 teaches that the RF insulator layer, in combination with the other elements of the temperature control system located above the ceiling, has a specific purpose, *i.e.*, to maintain the ceiling at a selected temperature for preventing polymer deposition. (Collins 1, col. 37:20-38). It is not apparent to us why the use of heaters within insulating layer for wafer heating devices would have prompted one skilled in the art to redesign the RF insulator layer of Collins 1 to also include heaters.

While the Examiner has made several rejections, resolution of the arguments presented by Applied Materials turns on whether the combined teachings of Collins 1, Imahashi, Tomoyasu, or Niori would have led one of ordinary skill in the art to arrive at an apparatus of the elected species.

As noted earlier, our decision on appeal is limited to a consideration of the elected species. We take no position as to the patentability of the other species encompassed by the generic claim. *Ex parte Ohsaka*, 2 USPQ2d 1460 (BPAI 1987).

DISPOSITION OF THE APPEAL

The subject matter of narrow claim 6-9 (with claims 7-9 depending directly or indirectly from claim 6) would not have been obvious over the prior art relied upon by the Examiner. Accordingly, we will reverse the rejections of claim 6-9.

As a result of PTO practice relating to an election of species, claims 6-9 appear to be patentable over the prior art, the Examiner will continue examination by looking into whether the non-elected species are patentable over the prior art. Whether applicable additional prior art will be found during further examination is not something we can know at this time. Accordingly, it may turn out that the broader claims on appeal and claims directed to the non-elected embodiments could be unpatentable over the prior art. We think that the proper course of action is to vacate the prior art rejections of claims 1-5 and remand to the Examiner so that the Examiner can feel free to apply any prior art rejection against claims 1-5, or for that matter any other claims, based on any additional prior art which may be found. We wish to make clear that nothing in this opinion should be construed as limiting the Examiner's ability to administratively handle further examination in any manner which the Examiner considers appropriate. Any doubt as to whether our opinion limits the Examiner's ability to take further action should be resolved in favor of the Examiner being able to take the action. Our mandate should be construed very narrowly.

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) (2006).

REVERSED-IN-PART and VACATED AND REMANDED-IN-PART

TOWNSEND AND TOWNSEND AND CREW LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

yt