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**Datasheet for the decision  
of 15 January 2018**

**Case Number:** T 0275/16 - 3.3.05

**Application Number:** 06728635.1

**Publication Number:** 1853518

**IPC:** C01G23/07, B01J35/02

**Language of the proceedings:** EN

**Title of invention:**

FINE PARTICULATE TITANIUM DIOXIDE, AND PRODUCTION PROCESS AND  
USES THEREOF

**Patent Proprietor:**

SHOWA DENKO K.K.

**Opponents:**

KRONOS INTERNATIONAL, INC.  
Sachtleben Chemie GmbH

**Headword:**

Titanium dioxide/SHOWA DENKO

**Relevant legal provisions:**

EPC Art. 83, 100(b)

**Keyword:**

Sufficiency of disclosure - (no)

**Decisions cited:**

T 0190/99, T 0792/00, T 1842/06, T 0518/10, T 0419/12

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

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Case Number: T 0275/16 - 3.3.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.05**  
**of 15 January 2018**

**Appellant:**  
(Patent Proprietor)

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**Decision under appeal:**

**Decision of the Opposition Division of the  
European Patent Office posted on 2 December 2015  
revoking European patent No. 1853518 pursuant to  
Article 101(3) (b) EPC.**

**Composition of the Board:**

**Chairman**            E. Bendl  
**Members:**            A. Haderlein  
                             R. Winkelhofer

## Summary of Facts and Submissions

- I. The present appeal lies from the decision of the opposition division to revoke European patent EP 1 853 518. The patent in suit concerns fine particulate titanium dioxide and its production process, and uses thereof.
- II. According to the decision under appeal, the main request, i.e. the patent as granted, fulfilled the requirement of sufficiency of disclosure, but the subject-matter of claim 1 thereof was found to lack novelty. Auxiliary requests 1, 2 and 4 were found to lack sufficiency of disclosure, whereas the subject-matter of claims 1 and 8 of auxiliary request 3 was found to lack an inventive step. With regard to the requirements of Article 83 EPC, the opposition division held in particular that claim 1 of auxiliary request 1 encompassed the possibility that the particle diameter  $D_{50}$  equalled the absolute primary particle size. Such a sharp distribution of the particle diameter was however impossible to realise by the method of the patent in suit.
- III. The proprietor (appellant) lodged an appeal against this decision. With its grounds of appeal, it filed (new) auxiliary requests 4 to 7.
- IV. In the following passage, independent claims relevant for the present decision will be reproduced:

Main request (patent as granted)

"1. Titanium dioxide having a ratio  $D_{top} / D_{50}$  of 1 to 3 between the maximum particle diameter  $D_{top}$  and the average particle diameter  $D_{50}$ , wherein the  $D_{top}$  and  $D_{50}$

are determined based on observing the primary particles by a field emission-type scanning electron microscope and  $D_{50}$  is from 5 to 200 nm.

9. A process for producing the titanium dioxide as set forth in any one of claims 1 to 8, the process comprising performing a vapor phase process of reacting a titanium tetrachloride-containing gas with an oxidative gas to produce titanium dioxide, wherein when the titanium tetrachloride-containing gas and the oxidative gas are reacted by introducing each gas into a reaction tube, the temperature in the reaction tube being from 1,050 to less than 1,300°C; in the introduction of the titanium tetrachloride-containing gas and the oxidative gas into the reaction tube, the ratio (S1/S2) of the cross-sectional area (S1) of the reaction tube, and the sum total (S2) of cross-sectional areas of the inlet tubes for the titanium tetrachloride-containing gas and the oxidative gas is from 1 to 2.5; in the synthesis of titanium dioxide by the vapor phase process, the titanium dioxide produced by the reaction of titanium tetrachloride with the oxidative gas stays in the reaction tube for an average residence time of 0.005 to 0.08 seconds; and the titanium tetrachloride-containing gas and the oxidative gas each is preheated at 600°C to less than 1,200°C and then introduced into the reaction tube."

Auxiliary request 1 (dated 20 August 2015)

Claim 1 of this request differs from claim 1 of the main request in that it includes the feature "the primary particle diameter is 5 to 200 nm". The wording of process claim 9 is identical to the one of claim 9 of the main request.

Auxiliary request 2 (dated 23 October 2015)

Claim 1 of this request differs from claim 1 of auxiliary request 1 in that the feature "D<sub>50</sub> is from 5 to 200 nm" has been deleted. The wording of claim 9 is identical to the one of claim 9 of the main request.

Auxiliary request 3 (dated 20 August 2015 and previously filed as auxiliary request 4)

Claim 1 of this request differs from claim 1 of the main request in that the ratio  $D_{top}/D_{50}$  is limited to "1 to 2". The wording of claim 8 of this request is identical to the one of claim 9 of the main request, apart from the adjustment of the back reference.

Auxiliary request 4 (filed with the grounds of appeal)

Claim 1 further includes, compared to auxiliary request 3, the feature "a band gap of 3 eV to 3.2 eV". The wording of claim 8 is identical to that of claim 8 of the third auxiliary request.

Auxiliary request 5 (filed with the grounds of appeal)

Process claim 1 corresponds to a combination of granted claims 1 and 9.

Auxiliary request 6 (filed with the grounds of appeal)

Claim 1 is identical to claim 1 of auxiliary request 5 with the limitation of the  $D_{top}/D_{50}$  ratio to the range of 1 to 2.

Auxiliary request 7 (filed with the grounds of appeal)

Claim 1 corresponds to claim 1 of auxiliary request 6, further including the feature "a band gap of 3 eV to 3.2 eV".

V. The arguments of the appellant, as far as relevant for the present decision, can be summarised as follows:

The skilled person would construe claim 1 of the main request, and by way of reference also claim 9 thereof, to encompass particles or processes for their production having a  $D_{top}/D_{50}$  ratio of 1, which according to the appellant means: maximum particle diameter/median particle diameter. The respondents had not shown that a skilled person could not achieve a  $D_{top}/D_{50}$  ratio of 1. While it might be difficult to achieve such a value, the skilled person could include a separation or classification step after the method claimed in claim 9 in order to isolate particles having the same particle diameter. By doing so he would arrive at a  $D_{top}/D_{50}$  ratio of 1. The process according to claim 9 did not exclude further steps, such as the aforementioned isolation step. In particular, at 200 nm sieving might be possible in order to arrive at a monodisperse distribution, although this might be more difficult at values of as low as 5 nm.

VI. The arguments of the respondents, as far as relevant for the present decision, can be summarised as follows:

Claim 1 and, by reference to claim 1, also claim 9 of the patent as granted explicitly encompassed the possibility that  $D_{top}/D_{50}=1$ , i.e. that  $D_{top}$  equalled  $D_{50}$ . In this case, the primary particle size distribution



was monodisperse, i.e. the particles produced according to claim 9 were of one size only, the size having a value of 5 to 200 nm. The skilled person knew that such a monodisperse particle size distribution could not be achieved by a given production process like the one called for in claim 9 of the main request. As claim 9 related to a process for producing titanium dioxide called for in claim 1, the process was directed to obtaining particles directly from the process steps called for in claim 9. The appellant had not shown that monodisperse particle size distribution could be obtained by the process according to claim 9.

#### VII. Requests

The appellant requested that the impugned decision be set aside and that the patent be maintained as granted, and, in the alternative, that the patent be maintained based on auxiliary request 1 (dated 20 August 2015), auxiliary request 2 (dated 23 October 2015), auxiliary request 3 (dated 20 August 2015 and previously filed as auxiliary request 4), or auxiliary requests 4 to 7 (all filed with the grounds of appeal).

The respondents requested that the appeal be dismissed.

### **Reasons for the Decision**

1. Main request - sufficiency of disclosure
  - 1.1 Claim 9 is directed to a process for producing titanium dioxide as set forth in any one of claims 1 to 8, i.e. to a process for producing titanium dioxide having a ratio  $D_{top}/D_{50}$  of 1 to 3 where  $D_{top}$  is the maximum particle diameter and  $D_{50}$  is, as submitted by the

appellant, the median particle diameter. The parties agree that the wording of claim 9, by reference to claim 1, explicitly encompasses the value of  $D_{top}/D_{50}=1$  and that such a value refers to a monodisperse particle size distribution, i.e. where the maximum and the minimum particle diameters are equal and, thus, also the  $D_{50}$  diameter has the same value.

1.2 According to the appellant, the respondents have not shown that particles having a monodisperse particle size distribution could not be obtained in general or in particular in the case of the method claimed in claim 9. The respondents did not discharge their burden of proof in this respect.

1.3 This argument is not persuasive for the following reasons:

1.3.1 As submitted by the respondents, it was the prevailing technical opinion at the effective date of the patent in suit that no processes existed which would allow the production of titanium dioxide particles in a gas phase reaction, the particles all having the same particle diameter, i.e. having a monodisperse particle size distribution. It is also the board's conviction that it is common general knowledge that processes for the production of particles such as those processes of the vapour phase type called for in claim 9 will inevitably result in particles having some sort of particle size distribution where the  $D_{top}$  value is higher than the  $D_{50}$  value. This is due to a spatial flow velocity distribution of the reactants, and/or temperature distribution, resulting in a spatial concentration and reaction rate distribution.

- 1.3.2 Moreover, the patent does not contain data for the contentious  $D_{top}/D_{50}$  value of 1. In the examples, according to the invention, the  $D_{top}/D_{50}$  value ranges from as high as 2.4 to the lowest value of 1.9, the comparative examples showing values as high as 4.
- 1.3.3 The appellant did not contest the existence of this prevailing opinion and admitted that the patent did not contain an example with the contentious value, but only argued that the respondents had not shown that it was not possible to achieve a  $D_{top}/D_{50}$  ratio of 1.
- 1.3.4 It is true that the burden of proof of insufficiency of disclosure is, as a general rule, on the opponent (see the Case Law of the Boards of Appeal, 8<sup>th</sup> ed., III.G. 5.1.2c)). In the case of an invention which goes against the prevailing technical opinion, it is however the patent proprietor who needs to prove that the invention is sufficiently disclosed (T 792/00, reasons 3 to 5; T 1842/06, reasons 3.4, T 518/10, reasons 7.10.1; cf. T 419/12, reasons 1.1.4(6)).
- 1.3.5 In the case at hand, it is therefore the appellant who has to show that it is possible to arrive at a  $D_{top}/D_{50}$  ratio of 1 when using the process disclosed in the patent in suit.

According to the appellant, while it may be difficult to arrive at  $D_{top}/D_{50}$  ratios of 1 or close to 1 using the process steps called for in claim 9, it was possible to further classify the particles thus obtained, for example, by sieving and by so doing to arrive at a monodisperse particle size distribution. This argument is not persuasive because claim 9 is directed to a process for producing the titanium dioxide as set forth in claim 1. This means that the

process according to claim 1 should, apart from a purification step such as dechlorination (cf. claims 15 et seq.), directly result in particles according to claim 1 without further separating and/or classifying the particles. This claim construction is also in line with the description and in particular with the examples where the  $D_{top}/D_{50}$  ratio is measured after the vapor phase process called for in claim 9 and is followed by a dechlorination step. As conceded by the appellant, the patent specification does not contain any reference to a further classification step such as a sieving step or the like.

Moreover, the board is not convinced that particles having a primary particle diameter of 5 to 200 nm can be easily separated and classified using mechanical means such as sieving. In particular, the appellant has not referred to any method that could possibly be used, specifically on an industrial level (cf. paragraph [0021] of the patent in suit), in order to separate particles having a primary particle diameter of as low as 5 nm, i.e. the lowest value encompassed by claim 1.

1.3.6 For the above reasons, the appellant has not shown that the  $D_{top}/D_{50}$  ratio having a value of 1, a value which is explicitly claimed in claim 1, can be achieved using the method disclosed in the patent.

1.3.7 For the sake of completeness, the board observes that even if the skilled person, who construes the patent with a mind willing to understand - not a mind desirous of misunderstanding (T 190/99, reasons 2.4) - considered claim 1 not to encompass a  $D_{top}/D_{50}$  ratio of 1 because such value cannot be achieved, the requirement of sufficiency of disclosure would not be met because the patent only discloses values of 1.9 and

above and the skilled person would be at a loss as to how to achieve values substantially below 1.9 and in particular close to 1.

1.4 For the above reasons, the requirement of sufficiency of disclosure is not met for the main request. The ground of opposition set forth in Article 100(b) EPC therefore prejudices the maintenance of the patent as granted.

2. Auxiliary requests 1 to 7 - sufficiency of disclosure

As conceded by the appellant, all auxiliary requests are directed to a process for producing titanium dioxide explicitly claiming a  $D_{top}/D_{50}$  ratio of 1. Therefore, the same reasoning applied to the main request applies *mutatis mutandis* to the auxiliary requests.

Therefore, none of the auxiliary requests comply with the requirement of sufficiency of disclosure set forth in Article 83 EPC.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



C. Vodz

E. Bendl

Decision electronically authenticated