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**Datasheet for the decision
of 15 September 2021**

Case Number: T 2016/19 - 3.3.09

Application Number: 12829275.2

Publication Number: 2754686

IPC: C08J5/18, C08L67/02

Language of the proceedings: EN

Title of invention:

BIAXIALLY STRETCHED POLYESTER FILM AND METHOD FOR PRODUCING
SAME

Applicant:

UNITIKA LTD.

Headword:

Biaxially Stretched Polyester films/UNITIKA LTD

Relevant legal provisions:

EPC Art. 56

Keyword:

Claims 1 to 6: inventive step - (yes)



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Case Number: T 2016/19 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 15 September 2021

Appellant: UNITIKA LTD.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 17 December
2018 refusing European patent application No.
12829275.2 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman F. Rinaldi
Members: A. Veronese
D. Rogers

Summary of Facts and Submissions

I. The appeal was filed by the applicant against the decision of the examining division refusing European patent application No. 12 829 275. The decision was based on claim 1 to 6 as filed by letter dated 1 June 2016.

II. Claims 1 and 3 read:

"1. A biaxially stretched polyester film, being a biaxially stretched film comprising a modified polybutylene terephthalate (modified PBT) and polyethylene terephthalate (PET), wherein a mass ratio (modified PBT/PET) between the modified PBT and PET is 20/80 to 5/95, the modified PBT is a PBT containing 5 to 20% by mass of a polytetramethylene glycol unit having a molecular weight of 600 to 4,000, an amount of tetrahydrofuran (THF) generated by heat treating the biaxially stretched film in a helium gas atmosphere at 180°C for 30 minutes is 50 µg/g or less, and the biaxially stretched film has tear linearity in a lengthwise direction thereof."

"3. A method for producing the biaxially stretched polyester film according to claim 1, wherein a modified polybutylene terephthalate (modified PBT) including 5 to 20% by mass of a polytetramethylene glycol unit having a molecular weight of 600 to 4,000 and giving an amount of tetrahydrofuran (THF), generated by heat treating in a helium gas atmosphere at 180°C for 30 minutes, of 800 µg/g or less and polyethylene terephthalate (PET) are mixed so as for a mass ratio (modified PBT/PET) between the modified PBT and PET to be 20/80 to 5/95, a film is formed from a resulting

mixture and a formed film is stretched, said modified PBT to be mixed with PET having been obtained by the polycondensation between the transesterification product of dimethyl terephthalate and 1-4-butanediol and polytetramethylene glycol (PTMG) having a molecular weight of 600 and 4000, and by drying polymerized PBT chip, wherein the drying method is selected from drying in a reduced pressure environment, drying in a nitrogen atmosphere, and drying in a hot air dryer."

III. The documents mentioned during the proceedings included:

- D1: JP 2006 150617 A (and D1', English translation of D1)
- D3: JP H11 163115 A (and D3', English translation of D3)
- D11: R.M. Lum, "Thermal decomposition of poly(butylene terephthalate)", *Journal of Polymer Science, Polymer Chemistry Edition*, 17, 1979, 203-213
- Annex A "Declaration of the Experimental Result", filed by the appellant by letter dated 1 June 2016, re-filed with the statement setting out the grounds of appeal

IV. The examining division found, *inter alia*, that:

- D1 was the closest prior art
- D1 disclosed a biaxially stretched polyester film comprising polyethylene terephthalate (PET) and modified polybutylene terephthalate (PBT) and that the film was suitable for carrying a vapour-deposited layer on its surface

- the film of claim 1 differed from that of D1 in that, under the conditions given in claim 1, it generated 50 µg/g or less of tetrahydrofuran (THF); the method of claim 3 differed from that of D1 in that the amount of THF present in the modified PBT used to prepare the film was 800 µg/g or less
- the underlying problem was the provision of a biaxially stretched film having higher cleanliness, suitable, for example, for semiconductor packaging
- relying on common general knowledge and the teaching of D3 and D11, the skilled person would have considered reducing the content of THF in the film of D1 and in the polymer material used to prepare it, e.g. by applying a reduced pressure and temperature; therefore, the claimed subject-matter did not involve an inventive step

V. Requests

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims 1 to 6, filed by letter dated 1 June 2016, which form the basis of the decision under appeal.

Reasons for the Decision

1. *Inventive step*

- 1.1 The claimed invention relates to a biaxially stretched polyester film having tear linearity which can be used, for example, as packaging material and electrical insulating material. The film comprises polyethylene terephthalate (PET) and a polybutylene terephthalate

(PBT) modified by the inclusion of polytetramethylene glycol units. This polymer composition allows a vapour-deposited layer having oxygen- and water-vapour barrier properties to be stably formed on one of the surfaces of the film (see paragraphs [0001], [0005], [0012], [0027] and [0028] of the patent application).

The closest prior art

- 1.2 The board agrees with the examining division that D1 is the closest prior art. This choice was not disputed by the appellant. Like the patent application, D1 discloses a biaxially stretched polyester film having tear linearity comprising a layer formed by vapour deposition imparting gas barrier properties (see the claims and paragraphs [0005], [0006] and [0014] of D1).

The difference

- 1.3 The board also agrees that the film defined in claim 1 differs from that of D1 in that, when it is treated in a helium gas atmosphere at 180°C for 30 minutes, it generates 50 µg/g or less of THF. Furthermore, the board agrees that the process of claim 3 differs from that of D1 in that the amount of THF generated by the modified PBT used to produce the film is 800 µg/g or less.
- 1.4 D1 does not mention the amount of THF generated by the disclosed film and the modified PBT used for its preparation. However, the tests conducted by the appellant (see Annex A) show that the amount of THF generated by a film according to production example 1 of D1 is 295 µg/g and that 5300 µg/g of THF is generated by the PBT used to produce such a film. Both these values are significantly higher than those used

to characterise the product and the process defined in claims 1 and 3 of the patent application.

Technical effect and underlying technical problem

- 1.5 The test results in the table on pages 21 and 22 of the patent application show that films comprising modified PBT and PET according to the invention, which generate small amounts of outgases, have the required tear linearity. These results also make it credible that, when the amount of THF generated by the film is maintained under the threshold of claim 1, a layer having advantageous oxygen- and water-vapour barrier properties could be formed by vapour deposition in a vacuum atmosphere (examples 1 to 16 on page 21).
- 1.6 By contrast, films comprising the claimed amounts of PBT and PET but generating amounts of THF exceeding those specified in claim 1 have inferior oxygen- and water-vapour permeability properties after vapour deposition of a layer in a vacuum atmosphere (comparative examples 1 to 3 on page 22).
- 1.7 Furthermore, example 1 shows that a method of film manufacturing according to claim 3, involving the use of a modified PBT generating less than 800 µg/g of THF, provides a film according to claim 1.
- 1.8 Taking into account these results, the underlying technical problem can be regarded as the provision of a biaxially stretched polyester film having tear linearity which can be coated in a vacuum atmosphere with a stable vapour-deposited layer imparting improved oxygen and vapour permeability, the film being suitable for packaging products such as electronic materials. This problem applies to the subject-matter of both

claim 1 and 3 and is apparent from paragraphs [0012] and [0022] of the patent application.

- 1.9 The examining division considered that the objective technical problem was "*to provide a biaxially stretched polyester film having higher cleanliness, which is required in certain applications, such as semiconductor packaging*". However, this formulation of the technical problem is not correct. First, it ignores the technical effects outlined and demonstrated with technical evidence in the patent application. Second, it contains a pointer to the claimed solution. Therefore, the board sees no reason for formulating the patent application's technical problem the way the examining division did.

Non-obviousness of the claimed solution

- 1.10 The examining division considered that since "*[i]t is known that modified PBT contains THF as an impurity (e.g. D3: paragraph [0005], D11: whole document)*", the skilled person would have considered reducing the content of THF in the film described in D1. Furthermore, it held that it was common practice "*to further purify a compound obtained in a particular chemical manufacturing process according to the prevailing needs and requirements*". According to the examining division, relying on common general knowledge and the teaching of D3, the skilled person would have subjected the film of D1 to "*reduced pressure and temperature over a certain period of time in order to provide a material with the required reduced volatile impurity level*". In this manner, the skilled person would have obtained the claimed film without exercising an inventive step.

This argument is not persuasive.

- 1.11 First, D1 does not teach that THF can negatively affect the barrier properties of biaxially stretched films. D1 addresses a different problem: namely that tear linearity decreases when printing is applied to a layer deposited by vapour deposition on the surface of a biaxially stretched film (see paragraphs [0004] to [0006]). Moreover, although THF is contained in large amounts in the films of D1, as shown in Annex A, its presence, much less any detrimental effects of it, is not even mentioned in D1. Thus, the skilled person would not have had any reason to reduce the content of THF in the films described in D1.
- 1.12 There is also no evidence that the large amounts of THF present in the films of D1 can be removed by applying a reduced pressure. Neither is there any evidence that subjecting stretched films to a reduced pressure is common practice and that such a process does not result in film degradation. It is worth noting that according to the manufacturing method described in the patent application, THF is not removed from the final film. Rather, its amount is reduced in the modified PBT before this polymer is mixed with PET to form the mass which is melt-extruded to form the final film.
- 1.13 D11 and D3 do not provide a pointer to the claimed solution either.
D3 is a patent application relating to wafer-retaining members obtained by subjecting thermoplastic polyester-based elastomer material with low amounts of volatile components to injection moulding. It teaches that, upon heating, THF can be released from the $-(CH_2)_4O-$ chains present in polyester-based materials, such as PBT (see claim 1 and paragraphs [0005] and [0010]).

D11 is an article investigating the thermal degradation of PBT teaching that THF is released from the PBT polymer chain at high temperatures (see abstract, page 206, first line and page 210, Figure 5).

- 1.14 However, neither D3 nor D11 relates to biaxially stretched films, let alone films which can be effectively coated with a vapour-deposited layer having gas barrier properties. Moreover, D3 teaches that to prevent the formation of THF, the temperature used for injection moulding should be 245°C or lower (see paragraph [0010] and the examples). As the appellant noted, this temperature is significantly lower than required to produce the PET/PBT biaxially stretched films according to the invention, i.e. 280°C (see example 1 of the patent application). The fact that D3 teaches a significantly lower temperature is a further reason for the skilled person not to take into account this document.
- 1.15 Finally, as the appellant noted, the amount of THF generated from the film according to the invention is significantly smaller than that released by the PBT material used for forming the film. For example, in example 1, a film generating 8 µg/g THF is produced using a PBT containing 280 µg/g THF, even if the processing temperature is 280°C. This finding is surprising and clashes with the teaching of D3.
- 1.16 For these reasons, neither D1 nor D3 or D11 would have given to the skilled person confronted with the underlying technical problem any incentive to provide a film as defined in claim 1 or a method for manufacturing such a film as defined in claim 3. Therefore, the subject-matter of these claims, as well

as that of dependent claims 2 and 4 to 6, which is narrower in scope, involves an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the examination division with the order to grant a patent on the basis of the set of claims 1 to 6 filed by the letter dated 1 June 2016 and an adapted description if required.

The Registrar:

The Chairman:



A. Nielsen-Hannerup

F. Rinaldi

Decision electronically authenticated