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D E C I S I O N
of 18 July 2006

Case Number: T 1127/04 - 3.2.07

Application Number: 00978664.1

Publication Number: 1242196

IPC: B05D 7/00

Language of the proceedings: EN

Title of invention:
Layered article with improved microcrack resistance and method of making

Applicant:
GENERAL ELECTRIC COMPANY

Headword:
-

Relevant legal provisions:
EPC Art. 56, 113

Keyword:
"Oral Proceedings - non-attendance although new request filed - right to be heard not violated in particular case"
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1127/04 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 18 July 2006

Appellant: GENERAL ELECTRIC COMPANY
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Representative: Szary, Anne Catherine
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 16 April 2004 refusing European application No. 00978664.1 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. O'Reilly
Members: H. Hahn
E. Lachacinski

Summary of Facts and Submissions

I. The applicant lodged an appeal against the decision of the Examining Division to refuse the European patent application No. 00 978 664.1.

The Examining Division held that claim 1 of the claims 1 to 14 as filed on 13 June 2002 upon entry into the European phase lacked an inventive step since the skilled person would have readily combined the documents D1 (EP-A-0 285 870), D2 (US-A-5 494 712) and/or D3 (WO-A-97 13802), thereby arriving at the concept of combining a polycarbonate substrate, an organopolysiloxane interfacial layer and an abrasion-resistant top layer comprising a plasma polymerized organosilicon compound into an abrasion resistant article.

II. With a communication annexed to the summons to oral proceedings dated 28 April 2006 the Board informed the appellant that claims 1, 2, 3, 7 and 15 of the single request underlying the appealed decision appeared to contravene Article 84 EPC while the claims 1 to 3, and 7 and 14 appeared not to meet the requirement of Rule 29(2) EPC. Furthermore, claim 1 appeared to lack an inventive step with respect to a combination of D1 with either D2 or D3. The Board further stated that in case that the appellant redrafts the claims in view of the Board's observations, then it might be necessary to consider the question of remittal.

III. With letter of 12 July 2006 sent by fax the appellant submitted an amended set of claims 1 to 12 and arguments with respect to the objections raised by the

Board under Rule 29(2) EPC and Article 84 EPC, particularly with respect to the non-incorporation of features into claim 1. The appellant further stated that the "applicants do not intend to be represented at the oral proceedings and **request that a decision be given based on the claims and arguments present in the written proceedings**" (emphasis in bold added by the Board).

IV. Oral proceedings before the Board were held on 18 July 2006 in the absence of the appellant. The appellant had requested, in writing, to set aside the decision under appeal and to grant a patent on the basis of the claims 1 to 12 filed with letter of 12 July 2006.

V. Independent claims 1 and 5 according to the single request read as follows (amendments made to claims 3 and 7 as filed on 13 June 2002 upon entry into the European phase are in bold, emphasis added by the Board):

"1. A multilayer article comprising:
a **polymer resin** substrate;
a first layer comprising a partial condensate of a diorganodiorganooxysilane having the formula $R_2Si(OR')_2$ or an organotriorganooxysilane having the formula $RSi(OR')_3$, or both, where R is independently selected from the group consisting of alkyl groups containing 1-3 carbon atoms, aromatic groups containing 6-13 carbon atoms, the vinyl radical, the 3,3,3-trifluoropropyl radical, the gamma-glycidoxypropyl radical and the gamma-methacryloxypropyl radical, and R' is independently selected from the group consisting of alkyl groups containing 1-8 carbon atoms, aromatic

groups containing 6-20 carbon atoms, and hydrogen; and a second layer deposited on the first layer, the second layer comprising an organosilicon material which has been polymerized and oxidized in a plasma, the second layer containing silicon, oxygen, carbon, and hydrogen."

"5. A method of forming a multilayer article comprising: applying a first layer to a **polymer resin** substrate, the first layer comprising a partial condensate of a diorganodiorganooxysilane having the formula $R_2Si(OR')_2$ or an organotriorganooxysilane having the formula $RSi(OR')_3$, or both, where R is independently selected from the group consisting of alkyl groups containing 1-3 carbon atoms, aromatic groups containing 6-13 carbon atoms, the vinyl radical, the 3,3,3-trifluoropropyl radical, the gamma-glycidoxypropyl radical and the gamma-methacryloxypropyl radical, and R' is independently selected from the group consisting of alkyl groups containing 1-8 carbon atoms, aromatic groups containing 6-20 carbon atoms, and hydrogen; and applying a second layer on the first layer by plasma polymerizing an organosilicon material in excess oxygen."

VI. The appellant argued essentially as follows:

The set of claims takes account the comments in the annex to the summons concerning Article 84 and Rule 29(2) EPC. Previous claims 1 and 2 have been deleted and previous claim 3 has been renumbered as the only independent article claim while new claim 5 is based on previous claim 7 and is now the only independent method claim. Claims 1 and 5 were amended

to refer to polymer resin substrates based on the description, page 4, line 4, and the word "about" when used in connection with a range was deleted. The applicant considers that the feature concerning colloidal silica dispersion is a preferred feature of the invention. The language "typically" is, however, not regarded as an indication that this is an essential feature of the invention but merely as illustrating one embodiment. The man skilled in the art would understand that the term "excess oxygen" means that the amount of oxygen is in a stoichiometric excess of that required to oxidise all the silicone and carbon in the organosilicone material.

Reasons for the Decision

1. *Right to be heard (Article 113 EPC)*

When submitting by fax the letter dated 12 July 2006 containing the amended single request the appellant at the same time requested "**that a decision be given based on the claims and arguments present in the written proceedings**" (emphasis in bold added by the Board). Since the appellant in the same letter stated that it would not attend the oral proceedings it took the risk that the decision handed down to it can be based on new facts, evidence and/or arguments put forward during those oral proceedings (see Case Law of the Boards of Appeal of the European Patent Office, 4th edition 2001, section VI.B.3).

In the present case the decision is, however, neither based on new evidence nor on new arguments since the

arguments presented by the Board with respect to product claim 1 in its communication annexed to the summons dated 28 April 2006 and also the arguments presented by the Examining Division in its decision fully apply to independent method claim 5 of the single request on file.

The Board remarks that said former method claim 7 did not comprise a limitation to a specific power level range of 10^6-10^8 J/Kg to be used for depositing the second layer in the plasma polymerization step and therefore resulted in a broader range of multilayer articles including those defined in claim 1 underlying the impugned decision. The method for making a multilayer article according to said former method claim 7 thus covered the multilayer article according to former product claim 1 which comprised such limitation to a specific power level range of 10^6-10^8 J/Kg for depositing the second layer. Since method claim 5 besides the limitation to polymer resin substrates corresponds to former method claim 7 it still covers a process for making the multilayer article according to former product claim 1 which had been considered by the Examining Division to lack an inventive step.

On considering the case at the oral proceedings, duly held pursuant to Rule 71(2) EPC despite the absence of the appellant, the Board therefore came to the conclusion that the subject-matter of claim 5 lacked an inventive step for the reasons already set out in said communication dated 28 April 2006 (compare point 2 down below). Consequently, there exists no need to discuss

the further requirements of Articles 54, 84, 123(2) and of Rule 29(2) EPC of the present single request.

2. *Inventive step (Article 56 EPC)*

Method claim 5 of the single request, except for the restriction to polymer resin substrates, is identical with method claim 7 underlying the impugned decision of the Examining Division. Said former method claim 7 defined the process steps for making a multilayer article comprising a first layer comprising a partial condensate of a diorganodiorganooxysilane having the formula $R_2Si(OR')_2$ or an organotriorganooxysilane having the formula $RSi(OR')_3$, or both, where R is independently selected from a specific group of defined compounds, and a second layer on the first layer by plasma polymerizing an organosilicon material in excess oxygen. The restriction to polymer resin substrates does not further distinguish the method of claim 5 since all three documents D1 to D3 mention polycarbonate substrates, which are among the preferred ones of the present application (see page 4, lines 3 to 20; examples 1 to 5).

2.1 Document D1 is considered to represent the closest prior art (compare decision of Examining Division, point 5 of the reasons) and aims to provide a method for forming abrasion resistant polycarbonate articles. These articles include a polycarbonate substrate (primed or unprimed), an interfacial layer of an adherent resinous composition, and an abrasion-resistant top layer applied on said interfacial layer by plasma-enhanced chemical vapour deposition (PECVD) (see abstract; page 2, line 47 to page 3, line 6) -

having a top layer free from pinholes and microcracks (see page 2, lines 36 to 42). Organosilicons are particularly useful materials for forming the interfacial layer and non-limiting examples include the general formula $R^7_nSiZ_{(4-n)}$, wherein R^7 represents a monovalent hydrocarbon radical or halogenated monovalent hydrocarbon radical, Z represents a hydrolysable group (preferably a halogen, alkoxy, acyloxy, or aryloxy), and n may vary between 0 and 2 (see page 4, lines 11 to 34). Other examples include partial condensates of a silanol $R^8Si(OH)_3$, wherein R^8 is selected from the group consisting of alkyl radicals containing from 1-3 carbon atoms, the vinyl radical, the 3,3,3-trifluoropropyl radical, the gamma-glycidoxy-propyl radical and the gamma-methacryloxypropyl radical, with at least 70% by weight of the silanol being $CH_3Si(OH)_3$ (see page 4, lines 35 to 43). Furthermore, when greater hardness of said interfacial layer is desired the organosilicon material may have dispersed therein colloidal silica; optionally an UV light absorbing agent may also be comprised (see page 4, line 48 to page 5, line 40). Said interfacial layer may be applied by conventional methods such as spraying, roll coating, curtain coating, dip coating and brushing, optionally onto the primed surface (see page 7, lines 4 to 15). Said top layer is applied by the PECVD method and non-limiting examples of suitable abrasion-resistant materials obtained thereby include silicon dioxide, silicon nitride, silicon oxynitride, silicon carbide, silicon carbonitrides, boron oxide, boron nitride, aluminium oxide, aluminium nitride, titanium dioxide, tantalum oxide, iron oxide, germanium oxide, and germanium carbide. Silicon dioxide may e.g. be formed by reaction of tetraethoxy silane with excess

oxygen (see page 10, lines 26 to 52; page 13, Table 1; claims 26 and 28).

2.2 The method according to claim 5 differs from the method according to D1 in that as the abrasion-resistant second layer an organosilicon material is applied by plasma polymerization in excess oxygen.

2.3 The objective problem to be solved by the subject-matter of claim 5 is thus considered to be the provision of a method for making an abrasion-resistant multilayer polymer resin substrate article having an alternative abrasion-resistant second layer with high abrasion resistance and freedom from microcracks (compare application, page 2, lines 10 and 11).

2.4 The solution to this problem proposed by the application is the method according to independent claim 5. From the examples it is credible that the technical problem as defined in point 2.4 above has been successfully solved.

2.5 The proposed solution according to claim 5, however, is considered to be obvious in view of either D2 or D3.

2.5.1 D2 discloses a PECVD method for forming a non-cracking, clear, colourless, hard and strongly adhering plasma polymerized film containing Si, O, C, and H in a specific atom ratio at a power density of about 10^6 to 10^8 J/Kg (see abstract; column 7, lines 4 to 12 and lines 44 to 48) by reacting an organosilicone compound and excess oxygen (see column 1, line 45 to column 2, line 17). Said coating can be applied onto plastic substrates (see column 1, lines 38 to 41; column 7,

lines 13 to 25) such as polycarbonates (see column 4, lines 15 to 21). The organosilicone coating may be applied to e.g. optical lenses, plumbing fixtures, vanes, optical memory discs, tapes and cards, solar panels, LCD windows, fibres and the like (see column 8, lines 1 to 9). According to most of the examples said $SiO_xC_yH_z$ coating was deposited onto polycarbonate substrates (see examples 1-2, 4-5, and 7-8).

2.5.2 D3 discloses a plastic substrate having a first layer of an adhesion promoter, and a protective coating of a second plasma polymerized organosilicone compound deposited onto said first layer at a power density of 10^6-10^8 J/Kg in the presence of sufficient stoichiometric excess of oxygen to form a silicon polymer of $SiO_{1.8-2.4}C_{0.3-1.0}H_{0.7-4.0}$ layer (see abstract; page 3, lines 1 to 5; page 3, line 34 to page 4, line 8), optionally with an SiO_x top layer (see page 1, line 34 to page 2, line 26; page 3, lines 20 to 33). The coating layer provides abrasion and solvent resistance for the substrate while the adhesion promoter prevents the coating from peeling off the substrate which is useful for a LCD device (see abstract).

2.5.3 Although D1 teaches that the abrasion resistant top layer preferably should be selected from materials of the group consisting of the materials specified in claims 26 and 28 the skilled person would have combined D1 with either D2 or D3 which disclose plasma-polymerized abrasion resistant coatings of the type $SiO_xC_yH_z$ which are obtained by plasma-polymerization of an organosilicon compound at a power density of 10^6-10^8 J/Kg in the presence of stoichiometric excess of oxygen.

This is because the general teaching of D1 only requires an abrasion-resistant layer which may include those - non-limiting examples of suitable - materials specified in its aforementioned claims 26 and 28 (compare D1, claim 1 and page 10, lines 26 to 52).

2.5.4 Thereby the skilled person would have arrived at the subject-matter of claim 1. The second layer deposited at the specific power density range according to D2 (also according to D3) has improved abrasion resistance compared to layers deposited at lower power densities and does not as easily crack as layers obtained at higher power densities (see D2, columns 7, 4 to 12 and lines 44 to 48).

2.5.5 In this context the Board also considered that the application comprises no comparison examples with the closest prior art D1 which would allow to deduce that the microcracking and weathering resistance of the articles obtained according to claim 5 are indeed better than those of D1 (compare decision of Examining Division, point 5 of the reasons). Furthermore, although the Board repeated this fact in its communication, the appellant did not prove by submitting any evidence that the specific combination of layers according to former product claim 1 produces - the alleged - superior resistance to microcracking and weathering. Consequently, none of the appellant's arguments based on these superior properties can be accepted.

2.5.6 Furthermore, there exists no prejudice which would hinder the skilled person from applying the abrasion-

resistant layers according to D2 or D3 onto the interfacial layer of D1. As a consequence, the appellant's argument that the skilled person would not be motivated to combine the different multilayer coatings suggested by D1 to D3 cannot be accepted.

2.6 Therefore, the lack of inventive step objection made by the Examining Division to former product claim 1 in the Boards view was justified and likewise applies to independent method claim 5 of the single request.

2.7 The Board thus considers that the appellant's single request must fail as the subject-matter of a claim of the request does not comply with the requirements of Article 56 EPC, so that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Nachtigall P. O'Reilly