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(54) HOLLOW INSULATING PROFILE FOR ALUMINUM FRAMES, ALUMINUM FRAME COMPRISING SAID HOLLOW INSULATING PROFILE, AND METHOD FOR PRODUCING AN ALUMINUM WINDOW OR DOOR

(57) The present invention relates to an insulating hollow profile for use in aluminium frameworks. The insulating profile is made up of a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules. The invention also relates to aluminium frameworks comprising said insulating hollow profile and to windows or doors produced with such frameworks, as well as to their production process. The invention lies in the field of construction, in particular the industrial production of aluminium windows or doors.

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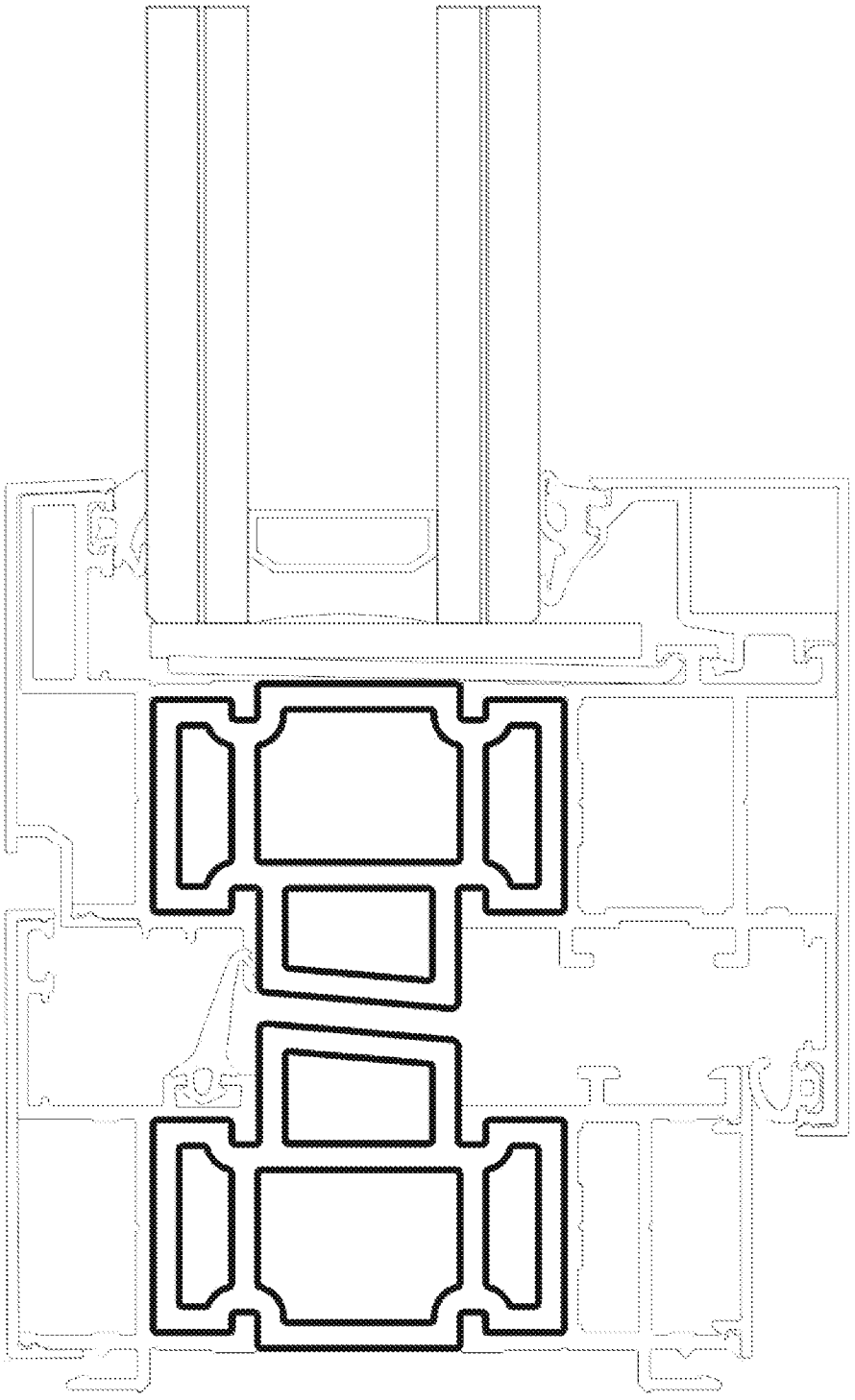

Fig. 3

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an insulating hollow profile, for use in aluminium framework, said insulating hollow profile being formed from the extrusion of a polypropylene and cork granules composite. The invention also relates to an aluminium framework comprising said insulating hollow profile, as well as to aluminium windows and doors comprising such frameworks and to their production process. The invention finds use in the field of construction, in particular in the industrial production of aluminium windows or doors.

BACKGROUND OF THE INVENTION

[0002] The framework market is very competitive and increasingly demands very high-quality levels that include not only standardized, high-performance construction requirements, but also compliance with growing ecological suitability requirements, namely with regard to the use of biodegradable materials.

[0003] In fact, in the aluminium window and door framework industry, there has been a growing demand, in terms of research and development, for solutions that avoid or limit the use of derived petroleum products, without compromising the demanding technical performance requirements adopted in the industry.

[0004] Specifically, the thermal and acoustic insulation elements, used in the aluminium window and door frameworks, essential for good thermal and acoustic performance thereof, constitute a clear example that provides an opportunity to improve the relationship between technical performance and the growing concerns of ecological adequacy.

[0005] Effectively, in the current state of the art, the thermal or acoustic insulation elements or profiles for aluminium frameworks have been manufactured essentially from fiberglass reinforced polyamide, with proven efficiency from the thermal and acoustic point of view, although at significant environmental expenses.

[0006] Despite the efforts made with a view to altering or replacing these insulation elements with others made of more sustainable materials, skilled in the art have been confronted with difficulties in obtaining new alternative solutions that meet the necessary technical requirements essential for an adequate performance, namely with respect to:

- Adequacy or ease of adaptation of current production processes for insulation elements or profiles, namely by extrusion, to other more sustainable materials;
- mechanical strength, in particular tensile strength of new insulation elements or profiles;
- fastening of insulation elements or profiles to aluminium profiles;
- thermal and acoustic performance of insulation elements or profiles;
- performance in terms of air permeability, water tightness and wind resistance of windows or doors produced from insulated frameworks with insulating elements or profiles; and
- durability of the insulation provided by the insulation elements or profiles.

[0007] On the other hand, the economic viability of industrial production processes for new insulation elements or profiles is a very restrictive factor for replacing current insulation elements.

[0008] The difficulty in overcoming all the problems listed above has led the industrial production sector of aluminium windows or doors to relative stagnation with regard to the development and improvement of its thermal and acoustic insulation elements.

[0009] Some attempts to look for alternative solutions and materials for the insulation elements of frameworks can be found, for example, in the patent documents identified below.

[0010] Document EP3228793(B1), entitled "METHOD FOR IMPLEMENTING A FRAME AND FRAME THUS OBTAINED" discloses a method for producing a structure (1) including an opening (AA'-BB'), referred to as window free space, the structure being formed by two complementary half profiles (2, 3), respectively internal (INT) and external (EXT), arranged in opposition to each other and held, one against the other, by fastening means, delimiting between them a space (V) of closed volume. The volume space receives cork as an insulation material, in particular, expanded cork.

[0011] Document EP1589179(B1), entitled "Frame section member to be fastened on a support and corresponding door or window" discloses a section (100; 200; 301, 302) of structure to be fastened on a support (210; 311, 321), in particular a or frame of a window or of a door, the structure section (100; 200; 301, 302) having a glass layer profiled like a glass layer (102; 202; 315, 325), in such a way that the structure section has a profiled part (101; 201; 313, 323) on which the profiled glass layer (102; 202; 315, 325) is mounted, comprising the profiled part (101; 201; 313, 323) a material which, with regard to its thermal properties, is adapted to the material of the profiled glass layer (102; 202; 315, 325) and has a silicate as a substantial constituent and wherein the profiled part (101; 201; 313, 323) is formed from a glass foam, rigid foam or cork.

[0012] Document EP3889384 (A1) entitled "EXTRUDED WINDOW OR DOOR HOLLOW SECTION PROFILE, SYSTEM WITH SUCH A HOLLOW SECTION PROFILE AND FRAME MADE FROM SAME" discloses an extruded

profile of hollow section of window or door (1) with at least one fastening area (4) for fastening the hollow section profile (1) or to connect the hollow chamber profile (1) to an external component (3), whose fastening area (4) is designed and foreseen to receive a fastening (2) means profiled at the edge, whose hollow section profile (1) has at least one fastening channel (5) in the fastening region (4) which is oriented perpendicularly to a longitudinal extrusion direction (6) of the hollow section profile (1), whose fastening channel (8) has a longitudinal channel axis (7), is closed at its ends perpendicularly to the longitudinal channel axis (7) by an external wall (1a, 1b) of the hollow section profile (1).

[0013] There is therefore a need in the art to develop new thermal and acoustic insulation elements or profiles for aluminium door or window frameworks, which may constitute more ecological and productively more sustainable alternatives than the current polyamide-based insulation elements currently widespread in the art.

[0014] It is also necessary that such insulation elements or profiles simultaneously fulfil the demanding technical requirements required and standardized in the industry.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] A detailed description of the invention is made below with reference to the accompanying drawings, in which:

Fig. 1 schematically illustrates the rectangular section of an embodiment of a hollow insulating extruded profile of the invention.

Fig. 2 schematically illustrates a complex cross-section of another embodiment of a hollow insulating extruded profile of the invention.

Fig. 3 illustrates the section of the final geometry of an aluminium window with glass, shims and the insulating hollow profile shown in Fig. 2 applied.

SUMMARY OF THE INVENTION

[0016] The present invention relates to an insulating hollow profile for aluminium frameworks, said insulating profile characterized in that it comprises a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules, preferably comprising 80% by weight of polypropylene and 20% by weight of cork granules.

[0017] In an embodiment, the cork granules of said composite has density comprised between 50 - 60 Kg/m^3 and a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm.

[0018] Preferably, the polypropylene of said composite comprises a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C, more preferably comprises a melt flow index of 12 g/10 min, a softening temperature of 153 °C and a thermal deflection temperature of 82 °C.

[0019] The present invention also relates to an aluminium framework comprising hollow aluminium profiled elements and insulating hollow profiles, formed from a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules, preferably comprising 80% by weight of polypropylene and 20% by weight of cork granules, said insulating hollow profiles being attached to said hollow aluminium profiled elements.

[0020] The present invention also relates to an aluminium window or door comprising the framework as defined above.

[0021] The present invention also relates to a process for producing an aluminium window or door. The production process comprises the steps of:

- producing a framework from profiled, hollow, aluminium elements;
- producing insulating hollow profiles from a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules; and
- fastening said insulating hollow profiles to said hollow aluminium profiles.

[0022] In a preferred embodiment of the process of the invention, the step of producing insulating hollow profiles is carried out from a composite comprising 80% by weight of polypropylene and 20% by weight of cork granules.

[0023] Preferably, in the process of producing an aluminium window or door of the invention, said step of producing insulating hollow profiles is carried out by extrusion.

[0024] In a preferred embodiment, at said step of producing insulating hollow profiles of the process of the invention, the cork granules have density comprised between 50 - 60 Kg/m^3 and a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm.

[0025] In a most preferred embodiment, in said step of producing insulating hollow profiles, said cork granules have a

humidity of 0%.

[0026] More preferably, in said step of producing insulating hollow profiles, the polypropylene comprises a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C.

DETAILED DESCRIPTION OF THE INVENTION

[0027] The present invention relates to an insulating hollow profile, for application in aluminium framework, said insulating hollow profile being formed from the extrusion of a polypropylene and cork granules composite. The invention also relates to an aluminium framework comprising said insulating hollow profile and to an aluminium window or door comprising said framework, as well as to its production process. The invention finds application in the field of construction, in particular in the industrial production of aluminium windows or doors.

[0028] The insulating hollow profiles of the invention act as thermal and acoustic insulation elements when applied to aluminium structures that make up the window or door frameworks.

[0029] In the context of the present description, the term "comprising" should be understood as "including but not limited to". As such, said term should not be construed as "consisting solely of".

[0030] It should be noted that any X value presented in the course of the present description should be interpreted as an approximate value of the real X value, since such approximation to the real value would be reasonably expected by the person skilled in the art due to experimental and/or measurement conditions that introduce deviations from the actual value. Thus, for example, the reference to "80%" means a value of "about 80%".

[0031] Unless otherwise indicated, the ranges of values given in this description are intended to provide a simplified and technically accepted way to indicate each individual value within the respective range. By way of example, the expression "15% to 25%" or "between 15% and 25%" means any value within this range, for example 15%; 16%; 17%; 18%; 19%; 20%; 21%; 22%; 23%; 24%; 25%; or others, for example including a decimal place.

[0032] Within the scope of the present invention, framework is understood to be a set of profiled elements constructively arranged so as to form a window or door structure. Such profiled elements are hollow aluminium profiles, in which insulating elements are applied that provide thermal and acoustic insulation to the final structure constituting the window or door. In this way, it is possible to combine optimal strength/weight ratios with excellent levels of thermal and acoustic insulation in the structure of a window or door.

[0033] According to the present invention, "hollow insulating extruded profile" or simply "hollow insulating profile" means a hollow element, produced by extrusion, which is intended to be applied and fastened to aluminium, hollow profiled elements, constituents of a framework. The function of the "hollow insulating extruded profile" of the invention is to provide thermal and acoustic insulation to windows or doors formed from the frameworks provided with said "hollow insulating extruded profile".

[0034] Within the scope of the present invention, "cork granules" means fragments of cork whose granulometry is comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm.

[0035] Within the scope of the present invention, "polypropylene" or "PP" means a polymer, more precisely a thermoplastic, derived from recyclable propene or propylene (plastic). Due to its characteristics, it is a type of plastic that can be moulded using only heating, and is therefore classified as a thermoplastic.

[0036] In a most preferred embodiment of the invention, the polypropylene has a melt flow index (MFI) of 12 g/10 min, softening temperature (vicat) of 153 °C and thermal deflection temperature of 82 °C.

[0037] According to the present invention, the term "polypropylene and cork granules composite" means a material comprising a mixture of polypropylene and cork granules in the proportions of 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules, most preferably comprising 80% by weight of polypropylene and 20% by weight of cork granules.

[0038] Said polypropylene (PP) and cork granules composite of the invention has particular application in the production of insulating hollow profiles for aluminium frameworks, giving such frameworks a high thermal and acoustic performance, without compromising functional and mechanical performance thereof, and consequently the structure of the windows or doors built therefrom.

[0039] The present invention was developed from an attempt to use cork material in substitution for polyamides. This attempt was based on the fact that cork is a sustainable material with known thermal and acoustic insulating characteristics. On the other hand, the thermal insulation provided by cork also allows to improve sustainability due to the lower energy consumption involved.

[0040] However, the search for a cork-based material to replace the conventional polyamide proved to be extremely difficult.

[0041] The combination of thermosetting resins, such as polyurethane (PU) or the PP with cork material revealed numerous problems in the production of an insulating profile having the characteristics required by the Industry of production of windows or doors made of aluminium frameworks, namely with regard to obtain:

- insulating profiles with the required mechanical resistance;
- profiles with more or less complex shapes;
- profiles with the required tolerances;
- profiles with the necessary dimensional stability.

[0042] With regard to manufacturing processes for insulating profiles, the fact that a composite comprises cork poses the problem of limiting the operating temperatures of the production process to temperatures that do not degrade cork.

[0043] Initially, efforts were made to produce profiles with a solid (or massive) section from composites of cork and PU or PP. The results were unsatisfactory due to problems with the flow of the material or the material sticking to the production machine or its finishing being poor or not showing dimensional stability.

[0044] On the other hand, it was concluded that such a massive insulating profile, or, in other words, with a massive cross-section, would be too heavy for the intended use of insulating aluminium frameworks.

[0045] Only a hollow cross-sectional profile, or in other words a hollow profile, would be suitable for said application. However, the problems encountered in the production of a massive profile remain and tend to become more acute when producing a hollow profile, as shown in Fig. 1. These issues are even more complicated when it is intended to obtain hollow profiles with more complex shapes by extrusion such as, for example, what is illustrated in Fig. 2.

[0046] Surprisingly, it was verified that the use of the composite of PP and cork granules of the invention, as defined above and better described below, to form hollow insulating profiles, allows to solve the problems of the prior art, and the production problems listed above that derive from the use of cork material in a composite for insulating profiles.

[0047] In particular, it was found that the insulating profiles of the invention significantly reduce CO_2 emissions in their production compared to conventional insulating profiles based on polyamides and guarantee, at the same time, a thermal and acoustic performance considered adequate by the industry.

[0048] Effectively, Life Cycle studies were carried out which led to the conclusion that by replacing conventional polyamide with the composite of PP and cork granules of the invention, there is a reduction in environmental impact between 11% and 39%. It was also possible to conclude that each 1% of insulating material changed from conventional polyamide to extruded cork in the production of windows do the inventors represents 508,800 kg of CO_2 not emitted into the atmosphere. In another relevant aspect, it was found that, due to the fact that the composite of the invention has a superior thermal conductivity from the point of view of insulation compared to conventional polyamide, it is possible to obtain energy savings in the use phase of the final product, be it a window or a door.

[0049] Specifically, the present invention relates to an insulating hollow profile for aluminium framework, said insulating profile consisting of a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules.

[0050] It was verified experimentally that only the concrete and limited ranges mentioned above of PP and cork granules allowed to obtain insulating hollow profiles by extrusion, the profiles thus produced having the necessary characteristics of mechanical resistance, weight and thermal and acoustic insulation required by the industry.

[0051] Experiments originally carried out with different ranges and materials from those described above for the functional composite of the invention resulted in defective insulation profiles or even made it impossible to obtain a finished insulating profile form, resulting in elements unable to meet the technical requirements required by the industry.

[0052] Preferably, said composite comprises 75% by weight of polypropylene and 25% by weight of cork granules; more preferably it comprises 85% by weight of polypropylene and 15% by weight of cork granules; most preferably it comprises 80% by weight of polypropylene and 20% by weight of cork granules.

[0053] In a preferred embodiment, the cork granules of said composite have density comprised between 50 - 60 Kg/m^3. The use of cork granules within this range of density allowed adequate pressure to be obtained during the extrusion process of the hollow insulating profiles, thus contributing to an adequate flow of material during said process.

[0054] In another embodiment, the cork granules of said composite have a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm. The choice of granulometry within these ranges made it possible to maximize the effect of the low density of cork, maintaining good processability of the composite material during extrusion. In addition, it was found that the said range of granulometry has an impact on the surface finish of the hollow insulating profile, in particular the use of a granulometry within the range of 1 to 2 mm allowed to obtain the best surface finish (smoother) of the hollow insulating profiles produced.

[0055] Preferably, the polypropylene of said composite comprises a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C. It was verified experimentally that these characteristics of PP are relevant for obtaining hollow insulating profiles by extrusion, since they contribute to preventing the disintegration or breakage of the material (composite) during the extrusion process, still allowing to maintain the required dimensional tolerances of the hollow insulating profile obtained.

[0056] In a preferred embodiment, the polypropylene of said composite comprises a melt flow index of 12 g/10 min, a softening temperature of 153 °C and a thermal deflection temperature of 82 °C.

[0057] The present invention also relates to an aluminium framework comprising hollow aluminium profiled elements and insulating hollow profiles, such as the ones defined above, fastened in said hollow aluminium profiled elements.

[0058] Fastening the insulating hollow profiles of the invention to the hollow aluminium profiled elements can be carried out essentially as follows:

- by gluing. Gluing has advantages in the initial assembly and ease of separation at the end of the framework's useful life. However, it implies long curing times with corresponding associated production costs;
- by mechanical fastening. Mechanical fastening has good properties in terms of mechanical strength. However, it increases production costs as it involves several fastening elements and considerable labour, in addition to enabling the creation of thermal bridges and less ease of dismantling at the end of the useful life of the framework;
- by crimping. Crimping proved to be more reliable than previous fastening processes, as it had lower production costs and ensured the technical requirements defined by the industry.

[0059] The present invention additionally relates to windows or doors comprising the framework as defined above. Said windows or doors are the final products of interest to the consumer, which have shown excellent thermal and acoustic insulation characteristics, in line with the industry's demanding requirements, through the use of the hollow insulating profiles of PP composite and cork granules above defined. For illustrative purposes only, Fig. 3 shows a section of the geometry of an aluminium window with glass, shims and an insulating hollow profile (with thicker black line) of the invention.

[0060] The present invention further relates to a process for producing an aluminium window or door comprising the steps of:

- producing a framework from profiled, hollow, aluminium elements;
- producing insulating hollow profiles from a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules; and
- fastening said insulating hollow profiles to said hollow aluminium profiles.

[0061] In a preferred embodiment, the step of producing insulating hollow profiles is carried out from a composite comprising 80% by weight of polypropylene and 20% by weight of cork granules.

[0062] In a very preferred embodiment, the step of producing insulating hollow profiles is carried out from an extrusion of said composite of PP and cork granules.

[0063] Preferably, in the step of producing insulating hollow profiles, said cork granules have density comprised between 50 - 60 Kg/m^3 and a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm. For its part, preferably, said polypropylene has a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C; more preferably, it has a melt flow index of 12 g/10 min, a softening temperature of 153 °C and a thermal deflection temperature of 82 °C. As previously mentioned, these characteristics contribute to a better flow of the material, namely during extrusion and, consequently, to obtaining insulating hollow insulating profiles with better structural integrity and improved dimensional tolerances, which contributes to the improvement of the functional quality of the insulating profile.

[0064] Most preferably, in said step of producing insulating hollow profiles, said cork granules have a humidity of 0%. This characteristic makes it possible to obtain optimized insulating profiles, since it has been found that the presence of moisture in the cork granules during the production process can create holes in the material, thus impairing the necessary mechanical and insulating characteristics of the hollow insulating profile produced. Without wanting to theorize, it is thought that this phenomenon occurs due to the vaporization of the water possibly present in the cork granules due to the operating temperatures of the production process of the hollow insulating profile. This phenomenon is more recurrent in the extrusion production process.

[0065] Therefore, in order to obtain optimized hollow insulating profiles, a preliminary step of drying the cork granules is carried out before the extrusion of the composite. It has been found that this drying can be carried out for a period of time comprised between 30 minutes and 4 hours at a temperature comprised between 50 °C and 100 °C, preferably for 1 hour to 3 hours at a temperature comprised between 60 °C and 80 °C, more preferably for 2 hours at 70 °C. The skilled in the art will understand that these intervals are indicative, validated by the experimental activity carried out, and the relationship between drying time and temperature is normally inversely proportional, that is, the less time used, the higher the temperature to be used. For example, it was verified that when it is intended to spend 1 hour drying, the temperature of 80 °C will be adequate to obtain a humidity of 0%. The same goes for the most preferred values of drying for 2 hours at 70 °C. Naturally, the skilled in the art, in order to reach the same objective of 0% humidity, will be able to determine and use other relations between drying time and temperature, as long as this does not cause the degradation of the cork material.

EXAMPLES

[0066] Countless production tests were carried out by extrusion of insulating hollow profiles of the invention varying the compositions of polypropylene/cork granules (below mentioned by PP/GC).

[0067] The table below summarizes, in a qualitative way, the results (unsatisfactory -; satisfactory +; good ++; excellent +++) obtained in the production by extrusion of simple hollow profiles (of rectangular cross-section - Profiles 1) represented in Fig. 1, and of complex hollow profiles (of complex cross-section - Profiles 2) represented in Fig. 2, given the different proportions of PP/GC used in its production.

[0068] 20 rectangular cross-section profiles (P1) and 20 complex section profiles (P2) were produced for each PP/GC ratio shown in the table below.

[0069] For each PP/GC ratio presented, the granulometry of the cork granules used varied within the range of 0.05 mm to 3 mm in said sample of 20 P1 profiles and 20 P2 profiles.

[0070] The density of the cork granules was also varied in the said samples.

%PP/%GC / Profiles	70/30	75/25	80/20	85/15	90/10
P1	-	++	+++	+++	-
P2	-	+	+++	++	-

[0071] It was possible to verify that the use of cork granules with density comprised between 50 - 60 Kg/m^3 and granulometry between 1 and 2 mm provided improved results in terms of the processability of the material during extrusion and surface finish of the profiles obtained.

[0072] An improved surface finish of the profiles obtained was also observed, as well as optimized mechanical and insulation characteristics in them, when a previous drying step was applied (until reaching a humidity of 0%) of the cork granules used in the PP/GC composite submitted to extrusion.

[0073] The experimental results made it possible to conclude that, regardless of other aspects or parameters, only the use of a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules, allows to obtain extruded hollow profiles in a technically satisfactory way and meeting the regulatory requirements stipulated in the aluminium framework industry.

[0074] It is to be noted that although the present invention has been described with reference to its preferred embodiments, many modifications and alternatives can be made by one skilled in the art without departing from the scope of the invention, which is defined by the claims.

Claims

1. Hollow insulating profile for aluminium framework, **characterized in that** it comprises a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules.

2. Hollow insulating profile, according to claim 1, **characterized in that** it comprises a composite comprising 80% by weight of polypropylene and 20% by weight of cork granules.

3. Hollow insulating profile, according to any one of the preceding claims, **characterized in that** said cork granules have density comprised between 50 - 60 Kg/m^3.

4. Hollow insulating profile, according to any one of the preceding claims, **characterized in that** said cork granules have a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm.

5. Hollow insulating profile, according to any one of the preceding claims, **characterized in that** said polypropylene comprises a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C.

6. Hollow insulating profile, according to the preceding claim, **characterized in that** said polypropylene comprises a

melt flow index of 12 g/10 min, a softening temperature of 153 °C and a thermal deflection temperature of 82 °C.

7. Aluminium framework **characterized in that** it comprises hollow aluminium profiled elements and insulating hollow profiles as claimed in any one of claims 1 to 6 fastened on said hollow aluminium profiled elements.

8. Aluminium window **characterized in that** it comprises an aluminium framework as claimed in claim 7.

9. Aluminium door **characterized in that** it comprises an aluminium framework as claimed in claim 7.

10. Production process of an aluminium window or door **characterized in that** it comprises the steps of:

producing a framework from profiled, hollow, aluminium elements;
producing insulating hollow profiles of a composite comprising 75% to 85% by weight of polypropylene and 15% to 25% by weight of cork granules; and
fastening said insulating hollow profiles to said hollow aluminium profiles.

11. Process for producing an aluminium window or door according to claim 10, **characterized in that** said step of producing insulating hollow profiles is carried out from a composite comprising 80% by weight of polypropylene and 20% by weight of cork granules.

12. Process for producing an aluminium window or door according to claim 10 or 11, **characterized in that** in said step of producing insulating hollow profiles, said cork granules have density comprised between 50 - 60 Kg/m^3 and a granulometry comprised between 0.05 and 3 mm, preferably between 0.5 and 2 mm, more preferably between 1 and 2 mm.

13. Process for producing an aluminium window or door according to any one of claims 10 to 12, **characterized in that** in said step of producing insulating hollow profiles, said cork granules have a humidity of 0%.

14. Process for producing an aluminium window or door according to any one of claims 10 to 13, **characterized in that** in said step of producing insulating hollow profiles, said polypropylene comprises a melt flow index comprised between 10 g/10 min and 14 g/10 min, a softening temperature comprised between 145 °C and 160 °C and a thermal deflection temperature comprised between 75 °C and 90 °C.

15. Process for producing an aluminium window or door according to any one of claims 10 to 14, **characterized in that** said step of producing insulating hollow profiles is carried out by extrusion.

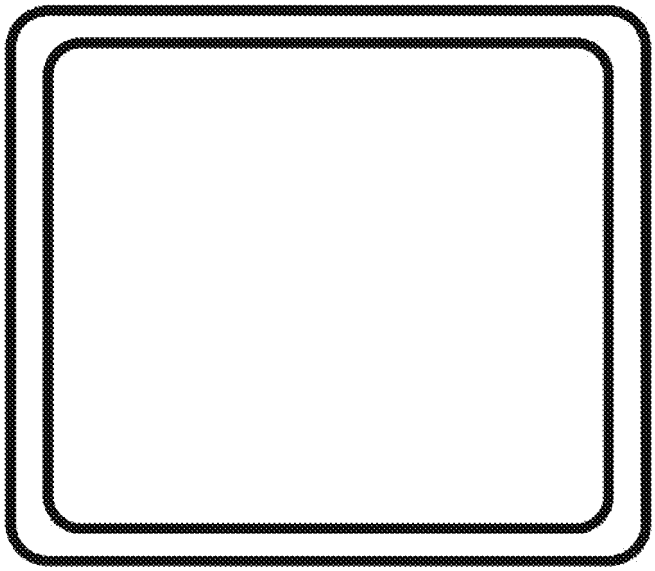

FIG. 1

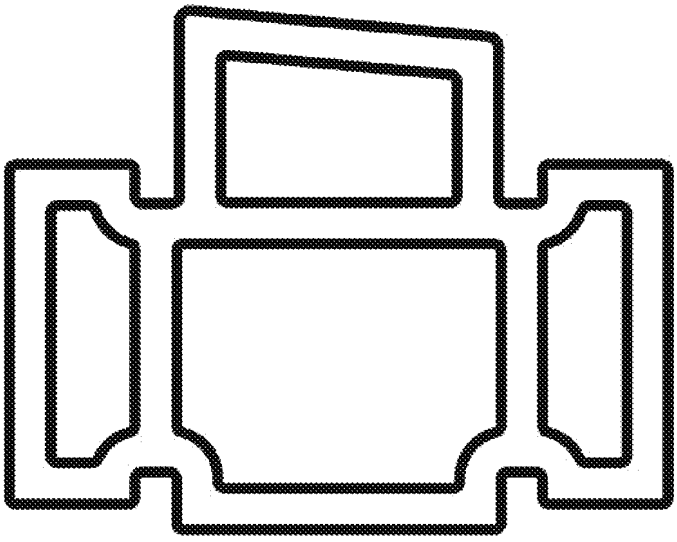

FIG. 2

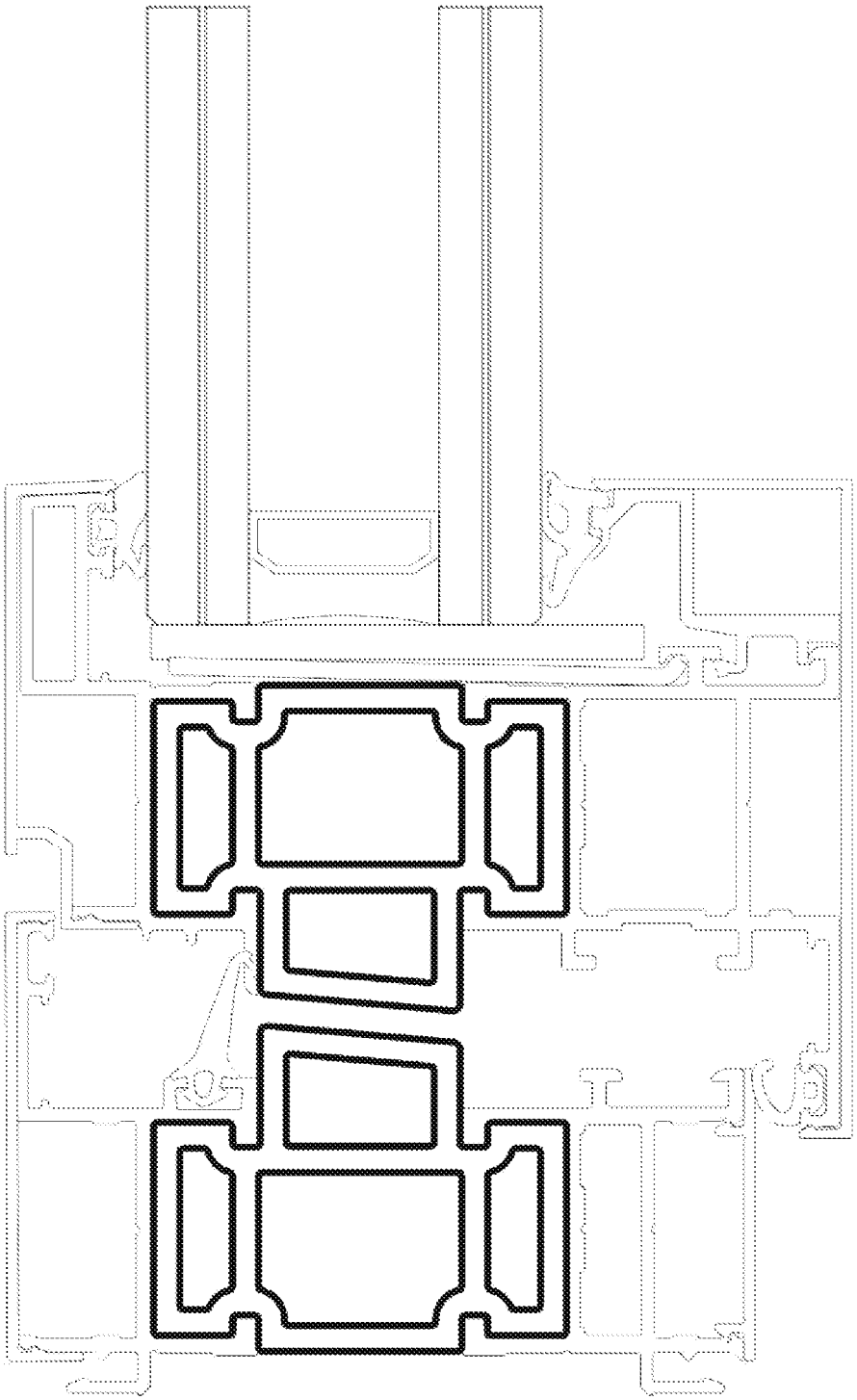

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2023/050017

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B3/263 B29C48/12
ADD. E06B3/273

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 256 280 A2 (TECHNOFORM CAPRANO BRUNNHOFER [DE]) 1 December 2010 (2010-12-01) figures 1-12 paragraph [0025] - paragraph [0027]	1-15
A	CN 105 804 588 A (WANG ZUOGANG) 27 July 2016 (2016-07-27) figures 1-5 paragraph [0004] - paragraph [0006] claims 1-3	1-15

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 October 2023	16/10/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Blancquaert, Katleen

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INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2023/050017

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 889 438 A1 (LG HAUSYS LTD [KR]) 1 July 2015 (2015-07-01) figures 1-3 claims 1-4,9,10,11 paragraph [0007] - paragraph [0010] paragraph [0014] - paragraph [0015] paragraph [0026] - paragraph [0034] -----	1-15
A	EP 3 159 127 A2 (CONENOR OY [FI]; VILKKI MARKKU [FI]) 26 April 2017 (2017-04-26) figures 1,2 claims 1-5 -----	1-15

1

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/PT2023/050017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2256280 A2	01-12-2010	AT 502182 T	15-04-2011
		CA 2682644 A1	09-10-2008
		CN 101688421 A	31-03-2010
		DE 202007016649 U1	30-04-2008
		EP 2044284 A1	08-04-2009
		EP 2256280 A2	01-12-2010
		JP 5368424 B2	18-12-2013
		JP 2010523842 A	15-07-2010
		RU 2009140304 A	10-05-2011
		US 2008256893 A1	23-10-2008
		US 2010115850 A1	13-05-2010
		WO 2008119535 A1	09-10-2008
CN 105804588 A	27-07-2016	NONE	
EP 2889438 A1	01-07-2015	CN 104583507 A	29-04-2015
		EP 2889438 A1	01-07-2015
		KR 20140027692 A	07-03-2014
		US 2015175801 A1	25-06-2015
		WO 2014035073 A1	06-03-2014
EP 3159127 A2	26-04-2017	CA 2994054 A1	10-08-2018
		CN 108407142 A	17-08-2018
		DK 3159127 T3	21-09-2020
		EP 3159127 A2	26-04-2017
		ES 2820854 T3	22-04-2021
		PT 3159127 T	01-10-2020
		US 2018229397 A1	16-08-2018

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 3228793 B1 **[0010]**
- EP 1589179 B1 **[0011]**
- EP 3889384 A **[0012]**