

(19) **DANMARK**

(10) **DK/EP 2805807 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **B 29 C 65/02 (2006.01)** **B 29 C 65/20 (2006.01)** **C 08 K 3/06 (2006.01)**
C 08 L 23/16 (2006.01) **E 06 B 7/16 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2018-01-08**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2017-10-11**
- (86) Europæisk ansøgning nr.: **14168856.4**
- (86) Europæisk indleveringsdag: **2014-05-19**
- (87) Den europæiske ansøgnings publiceringsdag: **2014-11-26**
- (30) Prioritet: **2013-05-23 DE 102013209608**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (74) Fuldmægtig i Danmark: **Awapatent A/S, Strandgade 56, 1401 København K, Danmark**
- (54) Benævnelse: **Tætningsprofil af EPDM, ethylen-propylen-copolymer og svovl til brug for dør- og vinduestætninger.**
- (56) Fremdragne publikationer:
EP-A1- 0 593 859
WO-A1-2008/094741
WO-A1-2013/131207
Eigenschaftan elastomermodifizierter Polyolefine - Rezeptureinflüsse des Schwefel-Beschleuniger-Systems S. Ilisch, R. Androsch, H.-J. Radusch, Halle, E. Šá• pirk, I. Hudec• , Bratislava (Slovak Republic) KGK Kautschuk Gummi Kunststoffe 55. Jahrgang, Nr. 1-2/2002

Sealing strip of EPDM, ethylene-propylene copolymer and sulfur for seals of doors and windows

Description

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The present invention relates to a gasket profile, in particular for windows and doors, made of a mixture of materials, and also to a process for the production of a component, in particular a window element or door element, which comprises the gasket profile.

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The said mixtures of materials are in particular plastics or are mixtures of various plastics of the type used for gaskets of any type: by way of example, elastomer gasket profiles are introduced into PVC window profiles and may then optionally also be adhesive-bonded. The adhesive-bonding disadvantageously requires an additional operation and therefore increases costs. However, if the mitred gasket profiles are not adhesive-bonded, shrinkage of the gasket profiles during their service time produces a gap into which, for example, rainwater can penetrate. Welding of elastomer gasket profiles is not possible, because these are crosslinked and therefore cannot soften (melt). Attempts to avoid problems have hitherto increasingly used thermoplastic gaskets (TPEs), which can be welded to one another in a single operation with the PVC window profile. However, thermoplastic gaskets are disadvantageous in respect of costs, processability, lifetime, etc. There is therefore a longstanding desire for a material, or a mixture of materials, which can be described as, and can be processed as, elastomer and has elastomer properties but at the same time, for example, can be welded.

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It is therefore an object of the present invention to provide a gasket profile made of a mixture of materials, in particular for windows and doors, and also to provide a process for the production of a component, where these eliminate the disadvantages described above.

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This object is achieved via a gasket profile according to Claim 1, and also via a process for the production of a component according to Claim 6. Further advantages and features are found in the dependent claims and the description.

5 According to the invention, a gasket profile made of a mixture of materials, in particular for windows and doors, comprises the following composition

- EPDM about 10 to 50 per cent by volume
- 10 • Copolymer about 8 to 50 per cent by volume
- Filler about 5 to 70 per cent by volume
- Paraffin oil about 0 to 20 per cent by volume
- 15 • Accelerator- about 0.1 to 5 per cent by volume
sulfur donor
- Sulfur about 0.5 to 5 per cent by volume
- 20 • Zinc oxide about 0.5 to 3 per cent by volume

The mixture of materials is further characterized in that the mixture of materials has a first state in which the EPDM fraction is uncrosslinked, and that the mixture
25 of materials has a second state in which the shape of the mixture of materials can be, and/or has been, changed, and that the mixture of materials has a third state in which the mixture of materials has been crosslinked, where the third state is subsequent to the second state. The mixture of materials is therefore not a traditional thermoplastic elastomer (TPE) such as PP/EPDM (Propylene/Ethylene-
30 Propylene-Diene rubber, also known as TPV). Those materials, e.g. TPV, are materials in which elastic polymer chains (crosslinked EPDM) have been incorporated (dispersed) in thermoplastic material (PP). They can be processed in

a purely physical process in combination with exposure to heat and subsequent cooling. No chemical crosslinking resulting from exposure to heat therefore occurs after the shaping procedure. A material of that type can be ground and reprocessed. The production process for a TPE extrudes the material, and dimensional stability is obtained by cooling the material. The mixture of materials is not cooled after the shaping process (extrusion), but instead is crosslinked by heating. The mixture of materials advantageously retains dimensional stability at higher temperatures, whereas at the same temperatures by way of example a TPE made of PP/EPDM melts and can undergo a change of shape. The mixture of materials exhibits no thermoplastic behaviour because its shape can no longer be changed by exposure to heat. The mixture of materials is the mixture specified above. The copolymer is a thermoplastic or a thermoplastic elastomer (TPE). The crosslinking process advantageously takes place after the shaping process, advantageously through exposure to heat (in a manner similar to that for elastomers). The mixture of materials advantageously does not melt on exposure to heat in the manner of a thermoplastic, but nevertheless can be welded. It is therefore possible to use processing methods which are the same as those used for conventional elastomer products, and this permits production of coextrudates of this weldable material with elastomer products. The EPDM fraction is advantageously uncrosslinked in the first state. In other words, the mixture of materials is therefore uncrosslinked in the first state. In the second state, the mixture of materials is designed to undergo change of shape. In the second state, the EPDM fraction or, respectively, the mixture of materials has not yet been crosslinked. The crosslinking occurs only after the shaping process, preferably with exposure to heat. The mixture of materials has advantageously been crosslinked or has crosslinked domains or segments. With this it is advantageously possible to achieve weldability. The copolymer can melt during heating/welding. Because the EPDM fraction in the third state has been crosslinked, no significant change of shape occurs here (weld bead). The melt from, for example, two gasket profiles welded to one another can mix at the contact site, thus producing a secure bond. In other words, in the third state the EPDM fraction and the copolymer have become intermixed. The mixture of materials is not a thermoplastic polymer (TPE), because the shape of the mixture of materials can no longer be changed by exposure to heat.

The mixture of materials is characterized in that the elastomer fraction is EPDM, and in that the EPDM fraction makes up to 10 to 50 per cent by volume of the mixture of materials. The additional material is a copolymer with various alkenes, e.g. ethene, propene, butene, octene, etc. It is self-evident that the mixture of materials also comprises further constituents alongside the EPDM fraction and the copolymer. Experiments have revealed that the formulation below has particularly good properties in relation to the requirements prevailing in the field of gasket technology:

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- EPDM about 10 to 50 per cent by volume
- Copolymer about 8 to 50 per cent by volume
- 15 • Filler about 5 to 70 per cent by volume
- Paraffin oil about 0 to 20 per cent by volume
- Accelerator- about 0.1 to 5 per cent by volume
20 sulfur donor
- Sulfur about 0.5 to 5 per cent by volume
- Zinc oxide about 0.5 to 3 per cent by volume

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Crosslinking agents used comprise sulfur and sulfur accelerators (accelerator-sulfur donor). The mixture of materials is therefore crosslinked by sulfur and sulfur accelerator, and specifically after the shaping process. The crosslinking advantageously takes place at a temperature in a region of about 150-250°C.

30 Crosslinking involves processes used in elastomer processing, e.g. vulcanization in a salt bath at 210°C.

The copolymer advantageously has no linkage sites and/or branching sites for a crosslinking agent or a crosslinking process. A polymer mixture with elastomeric character is advantageously used.

- 5 In a preferred embodiment, the copolymer is a propylene-ethylene copolymer, e.g. of the type represented by Versify 2300 from DOW. It is self-evident that the effects and advantages mentioned can also be achieved with other polymers or polymer mixtures, and the copolymer is therefore not restricted to this example.
- 10 The mixture of materials is advantageously characterized in that in the third state the mixture of materials can be, and/or has been, welded to itself and/or to an elastomer material. The great advantage is that in the third state the mixture of materials represents what may be called a chemically crosslinked elastomer which can be welded. The level of elasticity and strength of the weld can advantageously
- 15 be adjusted by way of the ratio of EPDM fraction to the copolymer. The mixture of materials can by way of example be welded in a single operation during the manufacture of a window frame or door frame. Mitred PVC window or door frames are generally subjected to hot-plate welding. It is now advantageously possible that, at the same temperature and in the same operation that bonds/welds the window
- 20 frames or door frames, the gasket profiles manufactured from the mixture of materials and introduced into the window frames or door frames are likewise welded to one another.

The mixture of materials is characterized in that it comprises filler, and in that the

25 filler content can be higher than in TPE/TPV. Examples of possible fillers are carbon blacks, carbon fibres, mineral fillers such as calcium carbonate or talc powder, glass fibres, etc., and also mixtures of the materials mentioned. The filler advantageously has a reinforcing effect, while the EPDM fraction provides strength and elasticity. The filler content is preferably in the range of about 5 to 70%,

30 preferably about 30 to 40%.

The mixture of materials is advantageously characterized in that the mixture of materials can be welded at a temperature of about 150° to 300°C. The temperature

at which softening or welding takes place is particularly preferably about 180 to 260°C. Welding of the mixture of materials can therefore advantageously take place for example, in a single operation with the welding of a window frame.

5 The mixture of materials is advantageously characterized in that the EPDM fraction forms segments or domains. In particular in the third state the EPDM fraction advantageously forms soft segments within the mixture of materials. By virtue of these soft segments, the mixture of materials can exhibit elasticity. The mixture of materials can advantageously comprise a polymer phase. The EPDM fraction can
10 further advantageously form segments or domains within the polymer phase. The additional material further advantageously forms segments or domains which provide weldability. The segments or domains formed by the additional material can advantageously melt during heating.

15 According to the invention, a gasket profile, in particular for windows and doors, comprises the abovementioned mixture of materials, where the mixture of materials has been produced by the following steps:

- mixing of the EPDM fraction and of the copolymer;
- 20 • provision, and admixture, of filler, paraffinic oil, accelerator-sulfur donor, sulfur and zinc oxide;
- moulding of the mixture of materials;
- crosslinking of the mixture of materials.

25 Mixing is advantageously carried out in an internal mixer up to about 150°C, preferably with a plurality of mixing stages.

Crosslinking takes place after the shaping process, preferably with exposure to heat.

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The mixture of materials has advantageously been produced in a manner such that it can be welded, in particular can be welded to itself.

According to the invention, a process for the production of a mixture of materials, in particular for window gaskets and door gaskets, comprises the following steps:

- provision, of EPDM material and of a copolymer;
- 5 • mixing of the EPDM material and of the copolymer;
- provision, and admixture, of filler, paraffinic oil, accelerator-sulfur donor, sulfur and zinc oxide to produce the mixture of materials;
- moulding of the mixture of materials;
- crosslinking of the mixture of materials.

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According to the invention, a component, in particular a window element or a door element, is provided which comprises a gasket profile manufactured from the material of the invention, where two components and the corresponding gasket profiles can be bonded in the same operation. The bonding is preferably achieved by coherent bonding, for example by hot-plate welding. The material of the component is advantageously by way of example PVC. It is therefore advantageously possible that, in a single operation, at least two components and gasket profiles thereof (for example profiles placed therein) are respectively welded to one another, i.e. that the two components are welded to one another and that the two gasket profiles are welded to one another.

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According to the invention, a process for the production of a component is provided, comprising the following steps:

- 25 • provision of at least two components, for example window frames or door frames;
- provision of at least two gasket profiles made of the abovementioned mixture of materials;
- introduction of the gasket profiles into the corresponding components;
- 30 • welding of the components and of the gasket profiles to one another in a single operation.

According to the invention, a gasket profile, in particular for windows and doors, is composed of a mixture of materials which comprises an EPDM fraction and a copolymer, and the said profile is characterized in that the mixture of materials has a first state in which the EPDM fraction is uncrosslinked, and in that the mixture
5 of materials has a second state in which the shape of the mixture of materials can be, and/or has been, changed, and in that the mixture of materials has a third state in which the mixture of materials has been crosslinked, where the third state is subsequent to the second state. A gasket profile of this type is preferably used in the field of windows, doors, facades and gates. Gasket profiles of this type are
10 likewise used in what is known as downstream manufacture of frame gasket profiles, where by way of example gasket profiles are mitred and welded.

It is self-evident that individual features of the embodiments described can be combined with one another. In particular, it should be noted that the advantages
15 and features of the mixture of materials also apply to the mixture of materials produced by the process according to the invention, and also to the process according to the invention and to the component according to the invention, and also vice versa and in any combination of the above.

P A T E N T K R A V

1. Tætningsprofil, fortrinsvis til vinduer og døre,
fremstillet af en materialeblending,
5 som frembyder følgende sammensætning:
 - 10 til 50 volumenprocent EPDM,
 - 8 til 50 volumenprocent copolymer,
 - 5 til 70 volumenprocent fyldstof,
 - 0 til 20 volumenprocent paraffinsk olie,
 - 10 0,1 til 5 volumenprocent accelerator-svovlgiver,
 - 0,5 til 5 volumenprocent svovl
 - 0,5 til 3 volumenprocent zinkoxid,hvor copolymeren er en termoplast eller en termoplastisk elastomer.
2. Tætningsprofil ifølge krav 1, hvor copolymeren er en propylen-ethylen-copolymer.
- 15 3. Tætningsprofil ifølge krav 1 eller 2, hvor materialeblendingen udviser en første tilstand, i hvilken EPDM-andelen ikke er krydsbundet, og hvor materialeblendingen udviser en anden tilstand, i hvilken materialeblendingen er omformelig og/eller omformet, og hvor materialeblendingen udviser en tredje tilstand, i hvilken materialeblendingen er krydsbundet, hvor den tredje tilstand foreligger efter den anden tilstand.
- 20 4. Tætningsprofil ifølge et af de foregående krav, k e n d e t e g n e t ved, at materialeblendingen i den tredje tilstand er svejsbar og/eller svejses med et elastomermateriale.
5. Tætningsprofil ifølge et af de foregående krav, k e n d e t e g n e t ved, at materialeblendingen er svejsbar ved en temperatur på cirka 150 ° til 300 °C.
- 25 6. Fremgangsmåde til fremstilling af et byggeelement, fortrinsvis et vindues- eller dørelement, hvilken fremgangsmåde omfatter trinnene:
 - at tilvejebringe mindst to byggeelementer, eksempelvis vindues- eller dørrammer;
 - at tilvejebringe mindst to tætningsprofiler ifølge et af de foregående krav;
 - at indføre tætningsprofilerne i de modsvarende byggeelementer;
 - 30 - at sammensvejse byggeelementerne og tætningsprofilerne i en arbejdsgang.
7. Fremgangsmåde ifølge krav 6, hvor byggeelementerne og tætningsprofilerne svejses ved en temperatur på cirka 150 ° til 300 °.