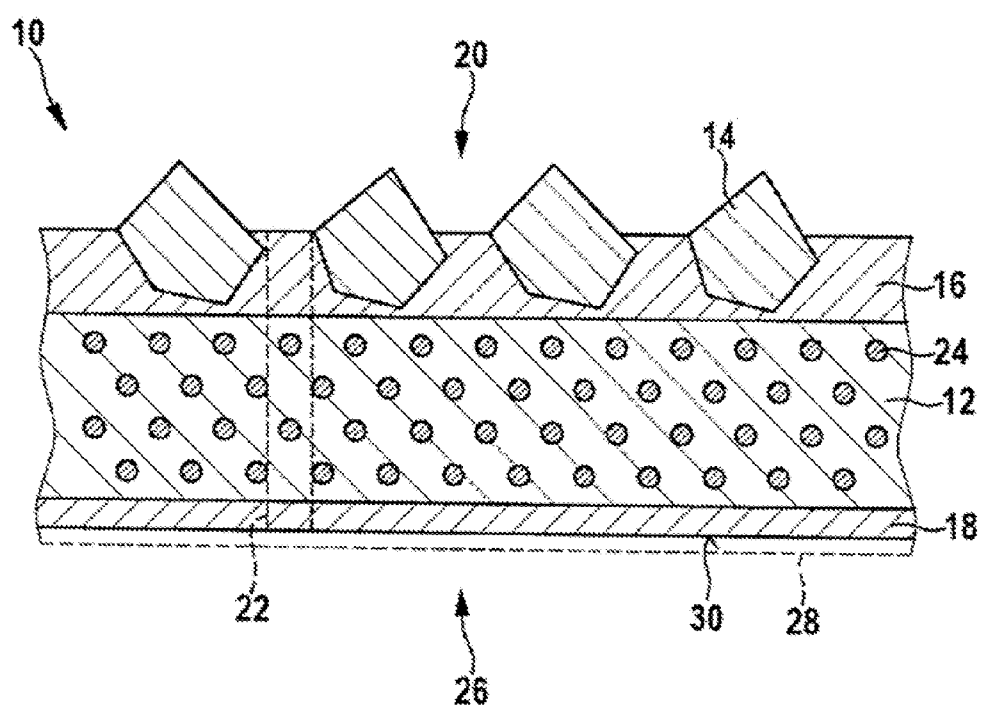


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A cross-sectional view of a material structure 10. The structure consists of a top layer 20 with a wavy, undulating surface. Below the top layer is a middle layer 12 containing a regular array of small circular features 24. The bottom layer 18 is a solid, uniform layer. The entire structure is shown in a perspective view with a dashed line 26 indicating the bottom edge. Other labels include 14, 16, 22, 30, and 28, which point to specific features or regions within the structure.



FIGURE

ABRASIVE DEVICE

[0001] This application claims priority under 35 U.S.C. §119 to patent application no. DE 10 2013 203 116.5, filed on Feb. 26, 2013 in Germany, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates to an abrasive device. An abrasive device, which has a substrate provided as a carrier element of a binder layer accommodating at least one abrasive grain and which has a fastening element, arranged on the substrate, for detachable fastening of the substrate to an abrasive handling device, is already known from EP 0 779 851 B1. The fastening element is there configured as a Velcro-type element or the like, by means of which the abrasive device can be fastened by a Velcro-type connection detachably to an abrasive handling device configured as a grinding disk.

SUMMARY

[0003] The disclosure describes an abrasive device, in particular a foam abrasive device, having at least one substrate, provided as a carrier element of a binder layer accommodating at least one abrasive grain, and having at least one fastening element, arranged on the substrate, for detachable fastening at least of the substrate to an abrasive handling device.

[0004] It is proposed that the fastening element is configured as an adhesion fastening element. The abrasive device can here be configured as a grinding wheel or as a grinding belt. The fastening element is here preferably connected integrally to the substrate. It is also conceivable, however, for the fastening element to be additionally or alternatively fixed to the substrate by means of a non-positive and/or by means of a positive connection. Particularly preferably, the abrasive device thus comprises at least one abrasive grain and at least one binder layer, in which the abrasive grain is at least partially arranged. The binder layer is preferably fixed to the substrate by means of an integrally bonded joint. All in all, the abrasive device preferably comprises a multiplicity of abrasive grains, which are arranged at least partially in the binder layer. To this end, the binder layer preferably comprises at least one base binder, which connects the abrasive grains integrally to the substrate. It is also conceivable for the binder layer to have, in addition to the base binder, at least a first top binder, which is applied to the base binder. Furthermore, it is likewise conceivable for the binder layer to have, in addition to the base binder and to the first top binder, a second top binder, which is applied to the first top binder. The base binder, the first top binder and the second top binder can here have any forms which appear sensible to a person skilled in the art, such as, for example, forms made of synthetic resin (epoxide, urea resin, melamine resin, unsaturated polyester resin, etc.) etc. Furthermore, the first top binder and the second top binder can comprise further active substances and/or fillers which appear sensible to a person skilled in the art.

[0005] The abrasive grain or grains of the abrasive device can be formed of a mineral and/or of a ceramic material, such as, for example, of diamond, of corundum, of emery, of garnet, of grindstone, of chert, of quartz, of sandstone, of chalcidony, of flint, of quartzite, of silicate material, of feldspar, of pumice, of talcum, or boron carbide, of cubic boron nitride, of fused corundum, of ceramic aluminum oxide, of aluminum zirconium oxide, of glass, of silicon carbide, of iron oxide, of

tantalum carbide, of cerium oxide, of tin oxide, of titanium carbide, of manganese dioxide, of zirconium oxide, of silicon nitride, etc. The abrasive grain or grains can here have any geometric form which appears sensible to a person skilled in the art, such as, for example, tetrahedral, truncated pyramid-shaped, triangular, cylindrical, etc. The abrasive grain or grains of the abrasive device is/are here preferably arranged, in a manner already known to a person skilled in the art, on and/or at least partially in the binder layer, such as, for example, by means of an electrostatic process, by means of a mechanical (gravimetric) process, etc.

[0006] The expression “detachably fastened” is here intended to define, in particular, a fastening of at least two elements one to another, which fastening is separable in a non-destructive manner, in particular is separable without the use of tools. The fastening element is preferably detachable from the abrasive handling device without leaving residues. The fastening element configured as an adhesion fastening element is preferably configured as an adhesion layer. The fastening element here has at least one adhesion surface, by means of which a detachable fastening of the substrate to an abrasive handling device can be achieved. The abrasive handling device can here be configured as a grinding disk, as a grinding block, as a manual grinding disk, etc. By means of the inventive design of the abrasive device, a comfortable fastening of the substrate, and thus of the entire abrasive device, to the abrasive handling device can advantageously be achieved. Moreover, a user-friendly exchange of the abrasive device can advantageously be achieved. Thus an operator can advantageously utilize an abrasive handling device for different versions of abrasive devices according to the disclosure.

[0007] It is further proposed that the fastening element is configured as a contact adhesive element. Thus the fastening element preferably has at least one contact adhesive surface. The contact adhesive surface preferably extends over a total areal extent of the substrate and/or of the fastening element. It is also conceivable, however, for the contact adhesive surface of the fastening element to be arranged only at certain points on the substrate. By means of the inventive design, a compact fastening element can be achieved. Moreover, a fastening element of simple design can advantageously be realized.

[0008] It is further proposed that the fastening element is configured as a pressure-sensitive contact adhesive element (PSA). By a “pressure-sensitive contact adhesive element” should here be understood, in particular, an adhesive element which is designed to produce, after an arrangement of a glued surface of the adhesive element on an element and a subsequent application of pressure to the adhesive element, a bonded joint. By means of the inventive design of the fastening element as a pressure-sensitive contact adhesive element, a high resistance of the fastening element to a shear load can advantageously be achieved. Thus a secure fastening to an abrasive handling device can advantageously be achieved.

[0009] It is also proposed that the abrasive device comprises at least the binder layer, which is arranged on a side of the substrate that is facing away from the fastening element. The binder layer, viewed along a direction running at least substantially perpendicular to an abrasive surface of the abrasive device, is arranged on a side of the substrate that is facing away from the fastening element. The expression “substantially perpendicular” is here intended to define, in particular, an orientation of a direction relative to a reference direction, wherein the direction and the reference direction, in particular viewed in one plane, form an angle of 90°, and the angle has

a maximum deviation of, in particular, less than 8°, preferably less than 5°, and particularly advantageously less than 2°. The expression “abrasive surface of the abrasive device” should here be understood, in particular, a surface, in particular a surface lying in an imaginary plane intersecting the abrasive grains arranged in and/or on the binder layer, which surface, during a grinding operation, touches a workpiece surface of a workpiece to be machined. By means of the inventive design, an incorrect assembly of the abrasive device can advantageously be prevented.

[0010] It is further proposed that the substrate is formed of a foam. The substrate can here be formed at least partially of polyurethane foam (PUR) or of ethylene vinyl acetate (EVA). Thus the abrasive device is configured particularly preferably as a foam grinding wheel. Preferably, the foam substrate is of flexible configuration. A particularly comfortable machining on poorly accessible portions of workpieces to be machined can hereby advantageously be enabled. Moreover, a shape of the binder layer provided with abrasive grains can advantageously be adapted to a contour of a workpiece to be machined. Thus a precise machining of a workpiece to be machined can advantageously be enabled.

[0011] It is further proposed that the substrate is formed of an open-pore foam. The substrate is here preferably formed at least partially of polyurethane foam (PUR). As a result, a particularly flexible substrate can advantageously be realized. Moreover, a low-weight abrasive device can advantageously be realized.

[0012] It is also proposed that the abrasive device has at least one suction cavity, which is introduced at least into the substrate. The suction cavity, viewed along a direction running at least substantially parallel to the abrasive surface of the abrasive device, here has a greater extent than pores of the foam substrate. By “substantially parallel” should here be understood, in particular, an orientation of a direction relative to a reference direction, in particular in one plane, wherein the direction has in relation to the reference direction a deviation, in particular, less than 8°, advantageously less than 5°, and particularly advantageously less than 2°. By means of the inventive design, an extraction of removed workpiece particles of a workpiece to be machined can advantageously be enabled. Thus a high ease of use for an operator can advantageously be created.

[0013] It is further proposed that the suction cavity extends through the substrate and the fastening element. The suction cavity, viewed along the direction running at least substantially perpendicular to the abrasive surface, preferably extends through the whole of the abrasive device. Thus the suction cavity, viewed along the direction running at least substantially perpendicular to the abrasive surface, extends through the binder layer, the substrate and the fastening element. A high extraction output of removed workpiece particles can advantageously be enabled. Thus a clogging of the abrasive grains with removed workpiece particles can advantageously be avoided.

[0014] It is further proposed that the substrate has a maximum thickness of more than 1 mm. The substrate preferably has a maximum thickness of more than 2 mm, and particularly preferably of more than 5 mm. Thus a stable abrasive device can advantageously be achieved.

[0015] In addition, a method is described for producing the abrasive device according to the disclosure. By means of the method according to the disclosure, a cost-effective abrasive

device, which can comfortably be fastened to an abrasive handling device, can advantageously be realized.

[0016] The abrasive device according to the disclosure and/or the method according to the disclosure should not here be limited to the above-described application and embodiment. In particular, the abrasive device according to the disclosure, and/or the method according to the disclosure for implementing a mode of operation described herein, can have a number deviating from a herein stated number of individual elements, components and units, as well as method steps.

[0017] Further advantages emerge from the following detailed description. In the FIGURE, an illustrative embodiment of the disclosure is represented. The FIGURE, the detailed description, and the claims contain numerous features in combination. A person skilled in the art will also expediently view the features individually and combine them into sensible further combinations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The FIGURE shows a detailed view of a portion of an abrasive device in a schematic representation.

DETAILED DESCRIPTION

[0019] The FIGURE shows an abrasive device **10**, which has at least one substrate **12** provided as a carrier element of a binder layer **16** at least partially accommodating at least one abrasive grain **14**. The substrate **12** is formed of a foam. The substrate **12** is here formed of an open-pore foam, such as, for example, of a polyurethane foam (PUR). It is also conceivable, however, for the substrate **12**, in an alternative form (not represented here), to be formed of a closed-pore foam, such as, for example, of an ethylene vinyl acetate foam (EVA). The substrate **12** formed of foam thus comprises pores **24**, which are arranged within the foam. The pores **24** are here configured as air pockets within the substrate **12**. The abrasive device **10** is thus configured as a foam abrasive device, which has a plastics substrate carrier element on which at least the binder layer **16** at least partially accommodating the at least one abrasive grain **14** is arranged. The substrate **12** has a disk-shaped form. Thus the abrasive device **10** is configured as a foam grinding wheel device. The substrate **12**, viewed along a direction running at least substantially perpendicular to an abrasive surface of the abrasive device **10**, further has a maximum thickness of more than 1 mm. It is also conceivable, however, for the substrate **12** to have a different geometric shape which appears sensible to a person skilled in the art, such as, for example, a polygonal shape, an elliptical shape, a circular-segment-like shape, etc., which has a thickness deviating from a thickness greater than 1 mm.

[0020] Furthermore, the abrasive device **10** comprises at least one fastening element **18** for a detachable fastening at least of the substrate **12** to an abrasive handling device (not represented in detail here). The abrasive handling device can here be configured as a grinding disk arranged on a tool holder of a portable machine tool (not represented in detail here), as a grinding block, as a manual grinding disk, etc. The fastening element **18** is fixed to the substrate **12** by means of an integrally bonded joint. The fastening element **18** is here fixed to the substrate **12** by means of a bonding process. It is also conceivable, however, for the fastening element **18** to be fixed to the substrate **12** by means of a different method which appears sensible to a person skilled in the art.

[0021] The abrasive device 10 further comprises at least the binder layer 16 and a multiplicity of abrasive grains 14 arranged in and/or on the binder layer. The binder layer 16 is fixed to the substrate 12 by means of an integrally bonded joint. The binder layer 16, viewed along the direction running at least substantially perpendicular to the abrasive surface of the abrasive device 10, is here arranged on a side 20 of the substrate 12 that is facing away from the fastening element 18. The abrasive grains 14 are fixed by means of a base binder of the binder layer 16, in a manner which is already known to a person skilled in the art, integrally in and/or on the binder layer 16. Portions of the abrasive grains 14 here project out of the binder layer 16, in a manner which is already known to a person skilled in the art, for material removal during a grinding operation. The binder layer 16 also comprises, in addition to the base binder, at least a first top binder, which is applied to the base binder. Furthermore, it is likewise conceivable for the binder layer 16 to have, in addition to the base binder and to the first top binder, a second top binder, which is applied to the first top binder. The base binder, the first top binder and the second top binder, starting from the substrate 12 and viewed in a direction directed away from the substrate 12, are here arranged in the following order: directly contiguous to the substrate 12 is arranged the base binder, after which follows the first top binder and then the second top binder. The base binder, the first top binder and the second top binder are respectively connected to one another in an integrally bonded manner. Further binders or constituent substances of the binder layer which appear sensible to a person skilled in the art are likewise conceivable. By means of the binder layer 16, the abrasive grains 14 are thus fixed to the substrate 12 by means of an integrally bonded joint.

[0022] In order to enable an extraction of removed workpiece particles during a grinding operation, the abrasive device 10 has at least one suction cavity 22 (shown in dashed representation in the FIGURE), which is introduced at least into the substrate 12. The suction cavity 22 extends at least through the substrate 12 and the fastening element 18. The suction cavity 22, viewed along the direction running at least substantially perpendicular to the abrasive surface of the abrasive device 10, here extends up to a surrounding boundary layer which closes off the binder layer 16. All in all, the abrasive device 10 comprises a multiplicity of suction cavities 22, which, if the abrasive device 10 is arranged on a grinding disk connected to a tool holder of a portable machine tool or on a wheel stand, which grinding disk or wheel stand is connected to a suction unit (not represented in detail here), are provided to enable an extraction of removed workpiece particles.

[0023] The abrasive device 10 can here be detachably arranged on the abrasive handling device. To this end, the fastening element 18 is configured as an adhesion fastening element. The fastening element 18 is here configured as a pressure-sensitive contact adhesive element. The fastening element 18 has at least one contact adhesive surface 30, by means of which the fastening element 18, and thus the abrasive device 10, can be detachably arranged on the abrasive handling device. Thus the abrasive device 10, following usage, can be pulled off from the abrasive handling device, in particular can be pulled off at least substantially without leaving residues. The fastening element 18, viewed along the direction running at least substantially perpendicular to the abrasive surface of the abrasive device 10, is arranged on the substrate 12 on a side 26 of the substrate 12 that is facing away

from the binder layer 16. The fastening element 18 is here configured as a contact adhesive layer, which extends over the entire side 26 of the substrate 12 that is facing away from the binder layer. It is also conceivable, however, for the fastening element 18 to be arranged, distributed at certain points, on that side 26 of the substrate 12 that is facing away from the binder layer. For protection of the fastening element 18 from contamination prior to use, the abrasive device 10 has at least one protective element 28. The protective element 28 is configured as a protective film, which is applied to the fastening element 18. Thus the protective element 28, before the abrasive device 10 is arranged on an abrasive handling device, is peeled off from the fastening element 18 by an operator to enable the fastening element 18, and thus the abrasive device 10, to be bonded to an abrasive handling device.

[0024] For production of the abrasive device 10, in a method step of a method for producing the abrasive device 10, the binder layer 16 is connected to the substrate. A base binder layer of the binder layer is here applied to the substrate 12. In a further method step of the method, the abrasive grains 14 are applied to and/or introduced into the binder layer 16. In a further method step of the method, it is here possible for a first top binder to be applied to the abrasive grains 14 arranged in and/or on the binder layer 16. It is also conceivable for a second top binder to be applied in a further method step of the method.

[0025] Furthermore, in a further method step, the fastening element 18 is applied to that side 26 of the substrate 12 that is facing away from the binder layer 16. After the fastening element 18 has been applied to the substrate 12, the protective element 28 is connected to the fastening element 18. It is also conceivable, however, for the protective element 28 to be already arranged on the fastening element 18 before the fastening element 18 is applied to that side 26 of the substrate 12 that is facing away from the binder layer 16. The fastening element 18 can in this case be applied to the substrate 12 as liquid film, which at least partially solidifies after a drying operation, or the fastening element 18 is configured as a flexible contact adhesive film, which is fixed to the substrate by means of a bonding process. Further forms of the fastening element 18 which appear sensible to a person skilled in the art are likewise conceivable.

What is claimed is:

1. An abrasive device comprising:
 - a binder layer configured to at least partially accommodate at least one abrasive grain;
 - at least one substrate including a carrier element of the binder layer; and
 - at least one adhesion fastening element configured to detachably fasten the at least one substrate to an abrasive handling device.
2. The abrasive device of claim 1, wherein the at least one adhesion fastening element is configured as a contact adhesive element.
3. The abrasive device of claim 1, wherein the at least one adhesion fastening element is configured as a pressure-sensitive contact adhesive element.
4. The abrasive device of claim 1, wherein the binder layer is located on a side of the at least one substrate that is facing away from the at least one adhesion fastening element.
5. The abrasive device of claim 1, wherein the at least one substrate is formed of a foam.
6. The abrasive device of claim 1, wherein the at least one substrate is formed of an open-pore foam.

7. The abrasive device of claim 1, further comprising:
at least one suction cavity which is introduced at least into
the at least one substrate.

8. The abrasive device of claim 7, wherein the suction
cavity extends through the at least one substrate and the at
least one adhesion fastening element.

9. The abrasive device of claim 1, wherein the at least one
substrate has a maximum thickness of more than 1 mm.

10. A method of producing an abrasive device, comprising:
supporting a binder layer with a substrate;
applying abrasive grains to the binder layer; and
applying an adhesion fastening element to the substrate,
the adhesion fastening element configured to detachably
fasten the substrate to an abrasive handling device.

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