The uneven surfaces of wood-based materials such as chipboard may be improved by applying a formable coating material, smoothing and/or modelling the coating material to achieve a smoother surface, and heating the coating material to form closed pores while maintaining the smoothed surface intact. Decorative and flexible layers may also be applied to such surfaces in this manner.
SURFACE IMPROVING PROCESS

0001 This invention relates to a process and an assembly for improving surfaces, preferably uneven narrow surfaces, of wood-based materials.

0002 Surface treatment processes of the type in question are widely used in the furniture industry. This is because the wood-based materials used in the furniture industry are not left in their original state, but are given an improving surface coating, mostly a melamine coating. The coating materials used also include veneers, decorative laminates or decorative films.

0003 A special edge material is often used for coating sides, edges or, generally, narrow surfaces. This special edge material may be, for example, an edge veneer or a so-called narrow-surface band which is applied to the narrow surfaces by means of an adhesive. This process is known generally as edge banding.

0004 However, it is often desirable to round off the narrow surfaces or edges on aesthetic grounds or to provide profiled surfaces for functional reasons. Other coating techniques besides edge banding, which is also known as soft forming, are used in the coating of such "soft" contours.

0005 One of the reasons for wanting to improve surfaces is that the surfaces to be coated are often very uneven, full of voids, etc. This applies in particular to chipboards.

0006 When coated by one of the processes mentioned above, surfaces such as these become noticeably uneven, “bumpy” or undulating which spoils the appearance of subsequent pieces of furniture for example. To obtain an improvement, thicker edge or coating materials are often used because they are able sufficiently to level out any unevenness in the surface and to avoid so-called telegraphing of the substrate. However, any increase in the thickness of the material is accompanied by an increase in the resilience of the bent coating material. This in turn means that a longer contact pressure zone is required for bonding the stiffer coating material. Moreover, thicker coating materials are generally more expensive.

0007 The process and assembly described in DE 44 42 397 for treating surfaces, more especially narrow surfaces, are better. Here, a formable coating material is applied and smoothed by means of a smoothing band. However, the surfaces obtained are again not smooth enough for all applications.

0008 Accordingly, the problem addressed by the invention was to provide a possibility by which the disadvantages mentioned above could be eliminated and which would enable surfaces to be smoothed in a simple manner.

0009 This problem has been solved by a process comprising the steps mentioned in claim 1 and by an assembly with the features defined in claim 7.

0010 The coating material is applied, for example, by a roller, an adjustable slot die or a transfer tape, preferably to the edge band (edge veneer). However, it may also be applied to the wood-based material. It is preferably applied to the surface by means of a transfer tape. This has the advantage that there is no need for an applicator roller adapted to the profile to be coated in order to apply the material. The manufacture of such profile-adapted applicator rollers or even specially adapted application nozzles is time-consuming and extremely expensive, especially where large numbers of different edge profiles are involved. In addition, different profiles cannot be coated in a short time.

0011 The coating material is preferably applied to the surface to be treated by pressure. A suitable pressure element applies a force to the band on its uncoated side so that the coated side of the transfer tape is pressed onto the surface to be coated.

0012 Application of the coating material is improved by additional heat treatment of the coating material or wood-based material. Infrared heaters, hot air fans, high-frequency heaters or the like are preferably used for this purpose.

0013 In one preferred embodiment of the process/assembly according to the invention, the coating material is applied to the transfer tape immediately before application to the surface to be coated. This is preferably done using a suitable applicator roller or an application nozzle which applies the material to the transfer tape in an adjustable thickness. In determining the material thickness, it is of advantage to increase it in the middle part of the transfer tape. As mentioned above, surface unevenness is at its greatest in particular in this region of the surface to be coated with the result that more material has to be used there.

0014 In another advantageous embodiment of the invention, the transfer tape is removed from the surface to be treated, the material having previously penetrated into and set or hardened in the pores of the surface to be treated so that it does not stick to the transfer tape when it is removed.

0015 Another advantageous embodiment of the invention is characterized in that, after removal, the transfer tape is returned to the application system so that an endless tape can be used.

0016 The transfer tape is preferably also used as a smoothing tape so that there is no need for smoothing rollers or smoothing blocks.

0017 However, smoothing or moulding can also be carried out by other known methods, for example by rollers and coating knives or by sanding after spray application.

0018 Further information on application and smoothing can be found in the relevant literature, e.g. in particular DE 44 42 397 to which reference is expressly made.

0019 The coating materials used may be both solid and non-solid, for example thixotropic, paste-like or highly viscous, at room temperature.

0020 Where importance is attached to simple processing and not to the particular performance properties of a thermoset material, thermoplastic materials are preferably used for coating. On the one hand, they combine well with the surface and, on the other hand, they are readily formable or smoothable.

0021 In order to enable commercially available hot melt applicators to be used to apply the thermoplastic coating material, the thermoplastic material should be sufficiently free-flowing during application. Good free flow of the material is important insofar as it is thus able better to wet the transfer tape, can be better applied to the narrow surface to be coated and, in addition, can penetrate better into the pores of the chipboard. To avoid excessive penetration, that
side of the coating or the transport tape remote from the narrow side is cooled, for example by means of a cold air blower or a cooling roller. That part of the coating material in contact with the transport tape thus hardens very quickly so that it “sink” less into the surface. This effect can be increased by foaming.

[0022] In addition, reactive non-thermoplastic materials can be used for coating. Specific examples of such materials include one-component or two-component systems based on polyurethanes, polyesters, poly(methyl)acrylates and epoxides. They may contain additives, for example fillers, pigments, dyes, thixotropicizing agents, catalysts and stabilizers. Decorative edges can be directly obtained by adding pigments or dyes.

[0023] Where reactive coating materials are used, it is important to avoid temperatures at which they harden by crosslinking in the mixing and metering units or during application and smoothing.

[0024] In addition, the coating material should lend itself to bonding, i.e. it should have a high affinity for the decorative layer applied at the same time or at a later stage.

[0025] The coating material or the wood-based material contains a “blowing” agent which forms pore-forming gases under the effect of the heated metal shoe. In the most simple case, the blowing agent is a readily volatile substance, for example water, a low-viscosity hydrocarbon or halogenated hydrocarbon. However, it may also be a substance which decomposes and forms gases, for example N,N'-azobisisobutyronitrile, toluene-4-sulfonyl semicarbazide, 4,4'-hydroxy-bis(benzenesulphon hydrazide) or azodicarboxylate acid diamide.

[0026] However, these pore-forming gases may also be formed during the hardening reaction of the reactive coating composition, for example CO₂ during the reaction of isocyanates with water. The hardening temperature and the hardening time are entirely dependent on the processing techniques and the coating materials used. In general, the temperatures are in the range from 50 to 250°C and, more particularly, in the range from 80 to 180°C while the contact times are between 1 and 300 seconds and, more particularly, between 2 and 20 seconds. Accordingly, this affords the advantage that the wood-based material can be continuously processed or at best only brief stoppages are necessary, depending on the layer thickness of the coating material.

[0027] The necessary heating unit may consist of a large metal block (heating shoe) which is heated to the necessary temperature by, for example, a heating cartridge. It is of advantage to use several small heating shoes, which can be variably adapted to varying contoured edge surfaces, rather than a single large heating shoe. The metal block can be shaped in such a way that it also has a smoothing effect (heating shoe). If the smoothing composition to be hardened is applied by the transfer tape to a contoured chipboard edge, the heating shoe has to be shaped in such a way or the group of small heating shoes has to be arranged in such a way that the flexible transfer tape is pressed onto the edge following all the contours or with any other required shape. It is important to use a flexible transfer tape which withstands the considerable heating involved in long-term use and transfers the heat to the smoothing composition to be hardened. It has been found in practice that glass-fibre- or Kevlar-reinforced teflonized bands (usable up to 260°C), for example, are suitable. A thin teflonized steel band may also be used.

[0028] In addition, it was found in the trials conducted thus far that the chipboard with its specific layer structure poses problems insofar as, although the anchorage and hence the adhesion of the smoothing composition in the porous middle part are good, adequate adhesion in the more highly compressed marginal zones can only be achieved with low-viscosity smoothing compositions. Here, it was found that roughening of the margins leads to a better, satisfactory result. Machine roughening can be carried out inexpensively in a one-pass machine using commercially available tools.

[0029] The described coating process may be used in particular for wood-based materials, such as solid wood, chipboards, blockboards, coreboards or plywood. However, the described process may also be used to coat uneven plastic materials or metals.

[0030] Besides smoothing surfaces, the coating material also offers protection against mechanical stressing. For example, metal rails on the edges of concrete formwork boards can be replaced by a coating of a material which hardens to form a thermost. Other applications are of course also possible.

[0031] Thus, a decorative layer can be laminated onto the smoothed narrow surface, preferably at the same time as the hardening process. Edges of PVC, ABS, PP or wood (veneer) may be used as the decorative layer. They may comprise one or more layers (laminate edges). Resin-imregnated paper in particular is used.

[0032] If, for example, a two-component polyurethane system is applied to the decorative edge material and if this adhesive-coated edge band is bonded to a straight or contoured edge of a chipboard, the thermost-forming hardening process can surprisingly be accelerated by a heating shoe so that, immediately after leaving the heating unit, it has advanced sufficiently for the subsequent steps (milling, capping). The polyurethane system is advantageously formulated in such a way that it reacts sufficiently quickly, but does not lead to troublesome hardening reactions in the mixing head itself. Accordingly, subsequent heating with the heating shoe enables an edge band to be bonded in-line onto the edge of the chipboard. Since the PUR adhesive hardens to form a thermost, the bond is highly resistant to heat and water, as required for example for kitchen and bathroom furniture. The expert would not have expected the combination of a quick-curing, but readily processable reactive coating material with a heated heating shoe to allow such rapid machine bonding that the subsequent processing steps, such as milling and capping of the edge overhang, can be carried out shortly thereafter, thus ensuring continuous production. In addition, the bond established is remarkably impervious.

[0033] The process according to the invention is applicable to the surface improvement of a wood-based workpiece not only by the edge banding of straight edges and by softforming (curved edges), but also by postforming, profile jacketing and 3D jacketing.

[0034] The following observations are intended to explain these three processes. If, in the case of an elongate wood-
based board, one of the two major surfaces and at least one of the two longitudinal edges rounded in some way are laminated with one and the same coating material, preferably a decorative laminate, such as CPL or HPL, the process in question is known as postforming. If not only the two longitudinal edges but also the surface of a long narrow wood-based material are profiled and if this profile workpiece is laminated with a decorative coating material, the process in question is known as profile masking. In so-called 3D masking (3D = three-dimensional), also commonly known as thermforming, veneer or a thermoplastic film, mostly of PVC, is laminated in thermforming presses—with or without a membrane—to a wood-based panel which is decoratively profiled on all four sides and possibly even on its flat surface.

[0035] Workpieces of a wood-based material with an uneven surface can be used in the above-mentioned processes after smoothing (particularly of the rough porous sides by the described process).

[0036] In all the processes mentioned, however, smoothing and lamination with a decorative coating material can be carried out simultaneously. This is shown in Example 4 for edge banding.

[0037] The invention is illustrated by the following Examples.

[0038] 1 Starting materials

[0039] 1. Reactive adhesive 1 is a one-component polyurethane based on MDI and polypropylene glycol.

[0040] 2. Reactive adhesive 2 is a two-component CaCO₃-filled polyurethane based on crude MDI and castor oil.

[0041] 3. Reactive adhesive 3 is a two-component system of a bisphenol A diepoxide and an amine hardener with an accelerator.

[0042] 4. Reactive adhesive 4 is a two-component polyester adhesive of an unsaturated polyester and benzoyl peroxide, dimethyl-p-toluide and cobalt octoate.

[0043] 5. Reactive adhesive 5 is a two-component methacrylate adhesive of polyurethane dimethacrylate and benzoyl peroxide.

[0044] The following tests were carried out with the above smoothing compositions.

EXAMPLE 1

[0045] A strand of the smoothing composition (see Table 1 below) is applied centrally to the rounded edge of a 19 mm chipboard with a softforming profile (round profile with a radius of 20 mm). The quantity is gauged in such a way that the edge is completely covered after the subsequent pressing step.

[0046] The edge coated with the smoothing composition is pressed against a heated metal rail of which the surfaces are adapted to the rounded chipboard edge. To prevent adhesion to the metal rail, silicone paper is used as an interlayer. The surface temperature of the heated metal rail: see Table 1.

TABLE 1

<table>
<thead>
<tr>
<th>Smoothing composition</th>
<th>Temperature of metal rail</th>
<th>Contact time</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive adhesive 1</td>
<td>150°C</td>
<td>10 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Reactive adhesive 2</td>
<td>150°C</td>
<td>4-5 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Reactive adhesive 3</td>
<td>150°C</td>
<td>15 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Reactive adhesive 4</td>
<td>150°C</td>
<td></td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Reactive adhesive 5</td>
<td>150°C</td>
<td></td>
<td>Hard, completely smooth surface</td>
</tr>
</tbody>
</table>

EXAMPLE 2

[0049] The two-component PUR adhesive is applied as smoothing composition to the surface of a flexible material—as listed in Table 2—which has an adhesive-repellent coating. The quantity is gauged in such a way that the edge is completely covered after the subsequent pressing step.

[0050] The material coated with the smoothing composition is pressed against the surface of the rounded chipboard edge (as described in Example 1) and cured by a heated metal rail (as in Example 1). The surface temperature of the heated metal rail: see Table 2.

[0051] After the contact time shown in Table 2, the chipboard workpiece is unclamped and pressed briefly against a similarly rounded cold metal rail to accelerate cooling.

[0052] The flexible material can be completely removed from the hardened chipboard edge.

TABLE 2

<table>
<thead>
<tr>
<th>Substrate material</th>
<th>Smoothing composition</th>
<th>Temperature of metal rail</th>
<th>Contact time</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone paper</td>
<td>Reactive adhesive 1</td>
<td>150°C</td>
<td>10 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Silicone paper</td>
<td>Reactive adhesive 2</td>
<td>150°C</td>
<td>4-5 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Teflonized paper</td>
<td>Reactive adhesive 3</td>
<td>150°C</td>
<td>7 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
<tr>
<td>Kevlar cloth</td>
<td>Reactive adhesive 4</td>
<td>150°C</td>
<td>3 secs.</td>
<td>Hard, completely smooth surface</td>
</tr>
</tbody>
</table>

EXAMPLE 3

[0053] A strand of the colored smoothing composition (see Table 3 below) is applied centrally to the rounded edge of a 19 mm chipboard with a softforming profile (round profile with a radius of 20 mm). The quantity is gauged in such a way that the edge is completely covered after the subsequent pressing step.

[0054] The edge coated with the colored smoothing composition is pressed against a heated metal rail of which the
Surface is adapted to the rounded chipboard edge. To prevent adhesion to the metal rail, silicone paper is used as an interlayer. The surface temperature of the heated metal rail: see Table 3.

[0055] After the contact time shown in Table 3, the chipboard workpiece is unclamped and pressed briefly against a similarly rounded cold metal rail to accelerate cooling.

[0056] With all the adhesive systems mentioned, the smoothing composition is cured and has a uniformly colored surface. The edge bead formed can be completely removed with a razor blade.

### EXAMPLE 4 (edge banding)

[0057] The adhesive is applied to the surface of 0.6 mm thick oak veneer or a film as listed in Table 4 (paper- or plastic-based).

[0058] The material coated with the adhesive is pressed against the surface of the rounded chipboard edge (as described in Example 1) and cured by a heated metal rail (as in Example 1). The surface temperature of the heated metal rail: see Table 4.

[0059] After the contact time shown in Table 4, the chipboard workpiece is unclamped and pressed briefly against a similarly rounded cold metal rail to accelerate cooling.

[0060] The flexible material is completely bonded to the rounded chipboard edge. The adhesive joint in the edge zone is not visible with the naked eye. The surface of the material stuck on is extremely smooth and has no undulation.

| TABLE 3 |
|-----------------------|---------------------|---------------------|
| Smoothing composition | Temperature of metal rail | Contact time | Result |
| Reactive adhesive 1 | 150° C. | 10 secs. | Hard, completely smooth white surface |
| Reactive adhesive 2 | 150° C. | 15 secs. | Hard, completely smooth blue surface |
| 2C epoxy adhesive 3 with 5% titanium dioxide | 150° C. | 4 secs. | Hard, completely smooth white surface |

| TABLE 4 |
|-----------------------|---------------------|---------------------|
| Coating material | Reactive composition | Temperature of metal rail | Contact time | Result |
| Oak veneer, 0.6 mm thick | Reactive adhesive 1 | 150° C. | 12 secs. | Completely smooth surface |
| Decorative paper film (75 g/m²) | Reactive adhesive 2 | 150° C. | 4 secs. | Completely smooth surface |
| Alkorcell film | Reactive adhesive 2 | 150° C. | 4 secs. | Completely smooth surface |
| Monolayer edge Igrafol (Bausch) | Reactive adhesive 2 | 150° C. | 5 secs. | Completely smooth surface |

1. A process for improving surfaces, especially narrow surfaces, of wood-based materials, characterized in that a formable coating material is applied to the surface, the coating material applied is smoothed and/or modelled and, in contact with at least one heated metal block, forms closed pores with the smooth surface in tact.

2. A process as claimed in claim 1, characterized in that the coating material is reactive and, more particularly, is a one- or two-component system based on polyurethane, polyester, poly(meth)acrylate or epoxide and hardens in contact with at least one heated metal block with the smooth surface in tact.

3. A process as claimed in claim 1, characterized in that the coating material remains thermoplastic.

4. A process as claimed in claims 1, 2 or 3, characterized in that the metal block has temperatures of 80 to 180° C.

5. A process as claimed in at least one of claims 1 to 4, characterized in that the contact time with the metal block is between 2 and 20 seconds.

6. A process as claimed in at least one of claims 1 to 5, characterized in that a decorative layer is adhesively applied during contact with the metal block.

7. An assembly for carrying out the process claimed in claims 1 to 6, characterized in that the heating shoe consists of several parts which are adapted to the required contour.

* * * * *