



Mundy Veneer

VERY IMPORTANT Guidance For Use of Tabu Veneers & Technical Recommendations

To produce an item of beauty great care needs to be taken. It is absolutely essential that the full version of Tabu's Technical Recommendations for Use are read and followed. They can be downloaded at www.mundyveneer.com or email sales@mundyveneer.com for a copy.

It is an inherent characteristic of wood that due to environmental moisture, heat and light the colour will change over time. Some species such as cherry, darken, mahogany and others fade and get lighter and some veneers yellow (e.g. maple and white veneers). The same is true for the Tabu dyed veneers: for example grey dyed veneers are inherently more unstable when exposed to light and can take on a green hue: the colour in pink, blue and red veneers may fade out. In addition the fading, darkening or colour change can be uneven depending on how the light and heat hits the wood and its environment. Also different parts of the grain will absorb the colour in different densities and so areas of tighter grain may appear darker. It is possible to minimise and/or delay this change and obtain good UNI light test results. Please note that white veneers will always yellow – the challenge is to minimise the yellowing and delay it as far as is possible. If the veneer is to be used in an area exposed to extensive UV light and/or heat consider if it is the best material to use. Always test finishes first in the environment it is to be used or similar, but please note that colour changes may take a while to happen. To ensure that you get the best results please take note of the following advice.

1. Choose and test your finish very carefully in the project environment

Finishes are of critical importance in reducing the speed and intensity of colour change. There are two critical elements which need to be addressed: First the finish/coating must not discolour (e.g. yellow) when exposed to light or UV; and second the underlying veneer must be UV protected too. Always seek specialist advice on which finishes to use for your project. Free samples are available on request to enable testing of finishes in the environment the veneer will be used.

The feedback we have received from the craftsmen and manufacturers we supply is that:

- Good results have been achieved using acrylic finishes with UV resistors. We suggest you take advice from finish specialists. Contact the technical teams at Woodfinishes (info@woodfinishes-ltd.co.uk – suppliers of ICA finishes) and Sherwin Williams Ltd (MClements@sherwin.com – suppliers of Sayerlack finishes). Both report very good results from customers using coatings with built in UV ray blocking filters and absorbers provided that the recommended process is followed. Be aware that high gloss finishes tend to be less UV resistant.
- A suitable light fast base coat /isolator first coat should be used.
- A/C or pre CAT coatings can result in strong adverse colour changes (e.g. grey veneer going green very quickly). We would suggest that they are not used.
- Using a UV curing line in the processing is incompatible with the use of UV inhibitors in the finish. UV inhibitors are essential to delay/minimise colour change.
- Please note standard Class 0 and Class 1 fire rated lacquers do not always contain UV filters but specialist finishes with UV filters are available. Please seek advice and test lacquered samples on site prior to installation.

2. Use the correct glue and test on samples first.

Using the correct glue for your project is crucial in achieving the desired outcome. Always seek specialist advice for your project. The Technical Team at Ureka Global (sales@thenamethatsticks.com) report good results from customers, their advice includes:

- UF (Urea Formaldehyde) Adhesives provide a durable bond line for all types of veneer
- Avoid using high acid fast cure UF hardeners, where a risk of staining and discolouration can occur
- There is a risk of veneer cracking, splitting and crazing if PVA (Poly Vinyl Acetate) Adhesives are used to bond veneer
- UF Adhesives are creep resistant in comparison with PVA Adhesives

Free samples are available on request to enable testing.

3. Order enough and use veneer from the same batch and be mindful of wastage

There will be variances between logs and bundles. To maximise colour uniformity and to reduce grain and marking variance (to the extent possible with natural wood), make sure you order enough veneer so that you don't need to mix batches or logs. Mundy Veneer provide a raw, unfinished product. Veneer bundles will require trimming and wastage needs to be considered when ordering. Wastage will depend on the species and use and will need to be calculated accordingly. Call for assistance.

4. Care in production and storage

The veneer is just one ingredient in the recipe. The skill is in the production. Contamination, using the wrong glue, an incompatible substrate, using inferior or inappropriate finishes, not allowing sufficient drying time, too high heat in the press or too long in the press and other incorrect processing are all examples of factors that can cause colour change, patchy discolouring and poor results. Similarly the chosen finish needs to be applied strictly in accordance with its specific recommendations to obtain the best results. Specific species and colours may require different processing. For example, white/pale veneers can be very translucent and may require white or grey coloured under veneering first. It is advisable to consider using colouring in the glue when working with more porous veneers (e.g. the multilaminar Caleidolegno and Newood veneers). For some veneers slip matching the veneer may give a more uniform look than book matching due to the effects of light refraction. For similar reasons all multilaminar veneers should be laid using the same side. Again we recommend that the joinery workshop experiment to ensure that they achieve the desired look. Further information is available at www.mundyveneer.com.

Finally raw dyed veneer is very susceptible to colour change – it needs to be covered with a UV resistant fabric out of sunlight before and during production and stored in accordance with the relevant Technical Data Sheets which are available to download at www.mundyveneer.com.

Each stage of the production cycle is critical in ensuring good long lasting results. As a result we regret that once it has left our warehouse we cannot give any guarantees nor accept any liability for discolouration of the veneer we supply except of course in cases of proven manufacturing defect. Please refer to our Terms and Conditions available at www.mundyveneer.com

Techrecv122023

T: +44 (0)1823 666 175
F: +44 (0)1823 666 485
E: sales@mundyveneer.com
W: www.mundyveneer.com



Mundy Veneer Ltd
4 Castle Road, Chelston Business Park
Wellington, Somerset TA21 9JQ

Technical Recommendations and Tabu's advice on ways of using natural veneers, pre-dyed TABU and Multilaminar Wood

Introductory remarks: the way in which any product is put to use is decisive, if the best result is to be obtained. Therefore it is advisable to follow the rules dictated by the characteristics of a natural living product. The realisation of a manufactured article is always the result of accumulated experience, art and technology which are the personal talents of the product's craftsman. The only purpose of the following recommendations is to put at everyone's disposal the years of experience gained from working together with craftsmen and manufacturers in this field.

The choice: The choice of a natural or pre-dyed veneer is most important since it must answer the requirements of size as well as the taste (as regards species, structure and colour) of the buyer. Normally, the goods in the warehouses are in lots, consisting of "trunks", each of a different character; it is therefore necessary that the buyer chooses very carefully, either personally or through trusted agents, or else by letting the supplier have the necessary information to find the materials best suited to the requirements. At this stage it is well to remember that there are certain natural characteristics in wood which in some cases may be considered defects, but which are in fact features. That is why it is advisable that the product be seen and selected according to one's own requirements.

Characteristics: structure, splay, knots, sapwood, fiddle back or mottled figure, irregular and more or less marked vein, colour variation even within the same trunk, knots and anything else specific to the wood species in question.

Defects (natural veneers): a catalogue of attributes of veneer which the user does not subjectively accept, are commonly referred to as "defects". Wood is a natural product and as such its appearance in certain cases may be pleasing or displeasing. It is therefore necessary to distinguish true defects from natural characteristics. Defects include: splits, holes, mould, marks resulting from processing, slicing marks left by the cutting blade, wormholes and whatever else has occurred as an external cause to change the appearance, which is not inherent in the wood species in question.

Defects (pre-dyed veneers): Tabu's pre-dyed veneers are nothing other than natural veneers which are dyed to the desired colour, and as such possess all their characteristics in all their effects. The defects may be considered as those occurring in natural wood. An additional defect can only be the lack of penetration of the dye, or an unacceptable colour.

Defects (Multilaminar wood): the following should be considered as defects: cracks, processing marks, holes, mould. Non-standard in structure or colour having regard to the standard samples. (Outside predetermined margins of acceptability).

Transportation: no precautions except to avoid breakage and exposure to outside weather conditions (sharp variations of humidity); this could produce moulds, with the consequent appearance of stains on being varnished.

Pollution: the criteria are the same for Natural Wood, TABU Pre-Dyed Wood and M. W. It is advisable to avoid discharge of the wood dust (from sanding) into water-courses: this could cause damage to aquatic plant and animal life.

Health and safety: protect airways and mucous membranes from the sanding dust.

Fire precautions: wood is inflammable, but not spontaneously so.

pH: about 7 (on delivery).



Measuring veneers: (moisture content 10-12%): the measuring process is carried out electronically therefore the squaring up takes account of the perimeter sizes. Repairs are made for any defective parts present in the veneer (holes, splits and whatever is considered a defect).

Tolerances: (TABU pre-dyed woods): slight colour variations (8-10 %) may occur from one batch to another. This is due to the differing rate of absorption of the wood itself, which varies from log to log and from species to species. The said range is, however, within customary acceptable limits.

Tolerances: (Multilaminar wood): slight colour and structural differences (8-10 %) may occur from one batch to another; this is due to the varying behaviour of the wood during processing. The said range is, however, within customary acceptable limits.

Colour control: wood and therefore veneers tend to oxidise, which results in surface colour changes. Therefore, in order to be able to compare the colour of two veneers, whether natural, pre-dyed or M.W. (still unvarnished), it will be necessary to sand them beforehand so as to remove the external part which may have oxidised.

Density: see the product specification according to wood species and Multilaminar Wood.

Toxicity: in some wood species there are substances which may contain a certain level of dangerous toxins. During processing TABU pre-dyed natural woods or M.W. lose a certain part of the lymph they contain and the substances added do not exceed in quantity the margins recommended; consequently these may be considered an improvement with regard to toxic effects.

Storage: wood is liable to absorb or lose atmospheric humidity and so should be stored in conditions which are neither too dry nor too moist (relative humidity about 50-60 %). Being also light-reactive, it should be kept in dark or covered conditions. If not, defects such as warping, colour variation, breakage and delamination (in M W) may result.

The selection: before carrying out joining procedures it is advisable to cut out those parts of the veneer which are defective or exhibit some undesirable characteristic.

Moisture content: the moisture content should be close to that of the substrate to which it is to be applied (about 12%). Wood has a tendency to swell due to its water-absorption properties; the moisture content therefore determines the size. If the relative values of the swelling of the substrate and the veneer at the moment of gluing are different, splitting or wrinkling of the veneer will result, with consequent filtration of the glue (pore-whitening). The humidity factor must therefore be closely monitored.

Clipping: during clipping, in order to achieve usable sizes for joining, it is advisable to ensure that the cutting blade is really sharp; a poor cut shows up the joins after veneering.

Joining: in this phase a "system" is selected, which may be book matching, slip matching, pleasing matching, random matching, etc. The joining process is carried out with adhesive paper, stapling with thermosetting glue points, or gluing along the veneer border. It is important to remove the residues left by this process in the sanding phase. Poor sanding can cause marks which appear at the varnishing stage.

The substrate: the substrate should be suitable for gluing, free from grease, or other substances, which may hinder the adhesion of the glues; dense, with a moisture content and temperature close to the veneer which is to be applied, in order to avoid cracking or delamination of the veneer itself after application. The colour of the base should be similar to the veneer which is to be applied in order to avoid one colour showing through after varnishing if it is too different.

Products for overlaying: various types of adhesives can be used according to the gluing system adopted: cold-setting gluing (Polyvinyl Acetate [PVA] or similar adhesives), thermosetting gluing (Urea-Formaldehyde [UF] or similar). As a rule, thermosetting ureic glues are used which by their nature tend to yellow. A high acid or alkaline content in the glues, the wood or the substrate, may produce a change of colour in the veneer immediately following the gluing phase or soon after. The cause may be attributed to a change in the pH due to varying values in the various elements, that is the substrate, the wood, the glues. The substrates, the veneers and the glues must therefore be "compatible"; the need therefore arises for research into suitable glues, which should be carried out in collaboration with the glue suppliers themselves. It is common practice to colour the glues to conceal bleeding through or porewhitening caused by penetration of the glue itself across the wood fibre. In such a case the colourants used should be compatible with the glue, with the colourants or acidic content of the veneer and with the varnish which is later to be applied. In short, great attention must be paid to the glues used together with close collaboration with the suppliers in order to achieve the best technical results bearing in mind production needs and the final result to be achieved.

Overlaying: the glue should be spread on the base evenly and in small quantity; it should be quite thick to avoid penetration into porous veneer causing bleeding through or pore-whitening which could become obvious at the varnishing stage. The application should be carried out quickly once the veneer has come into contact with the glue. If for any reason the time interval should lengthen and the veneer, having been glued, begins to buckle, hindering the operations still to be carried out, it will suffice to moisten the veneer itself on the visible surface with a light spray of water; it will then regain its original flatness. Wood being a natural product, possesses differing characteristics from species to species and from log to log; the hardness, the density, the heat conducting qualities may vary according to the moisture content and the nature of the wood fibres, which may differ from species to species. For example, birch has a different heat-conducting value from a tulip tree wood; sycamore has a finer texture than ash. At this point, at the pressing stage, the need for a whole series of adjustments emerges, which vary according to the wood species being used: pressure and compression, temperatures and pressing times, quantity of glue and cooling of the panels. In general terms, the following average values apply: press pressure 2-4kg/cm², temperature 80-90 °C, pressing time 4-5'. Strong pressure applied to woods with large vessels such as ash and oak facilitates glue penetration through the veneer (porewhitening). High temperatures used on highly heat-conducting wood causes scorching and consequent colour variation. Another important factor is the cooling of the panel after the application of the veneer. The substrates (particleboard, MDF and others) are agglomerates composed of wood and chemical products (glue). When these are exposed to heat, the evaporation of chemical product residues is facilitated, which appear on the surface and penetrate the veneer. It is therefore advisable to allow these vapours to evaporate during the cooling phase by means of free ventilation; placing anything upon the panels should therefore be avoided until they have returned to a normal temperature. These residual vapours can cause colour variation in veneers and possible deterioration of the colourants contained in them. In the case of hollow-core structure substrates it is advisable to make air-holes to relieve pressure which forms at high temperatures within the hollow-core structure itself, in order to avoid fissuring. In the case of burrs or wavy veneers it is advisable to flatten them before application, which involves applying pressure at 85-90 °C for about 1-2 minutes to individual sheets and then proceed with the application procedure. In applying a very light coloured veneer avoid the use of dark coloured bases in case the base colour shows through the veneer, changing its colour. Here we recommend carrying out a double veneer application, setting the fibre of each veneer at right angles to one another. It is normal to colour the glue when applying dark colour or very porous veneers, to conceal possible bleeding through. It is advisable, in this case, to avoid dyes which, by leaching from the glue, modify the veneer colour.

At the varnishing stage, marks of a different tone may appear. In the case of light woods, use colourless glues which are thick, and apply sparsely. In veneer application a basic rule must be kept in mind, which is that two veneers must never be placed on top of one another with their grains in the same direction, even if this involves applying a veneer to readymade plywood. Fissures could occur due to stress imbalance in the two veneers which are not balanced.

Back-overlaying: to avoid bending (cupping) the substrate must be counter-balanced with a veneer having the same dimensional variability and structure as the face veneer. It is not advisable to apply directly to particle board (e.g. MDF) veneers presenting high dimensional variability on exposure to moisture (e.g. burr, crotch) since checking and delamination may occur. In this case double application is recommended.



Filling: it sometimes happens during processing that some substrate to which a layer has already been applied has small fissures or breaks caused by previous working. In such a case the defects are made good with fillers (in colours to match the woods used), which are glue or synthetic resin-based commercially available ready-made; otherwise such fillers can be made up using oxides, kaolin and powdered colourants, mixed with fast-setting resins or glues, which are applied using a filling knife and sanded down when thoroughly dry. Where ready-made coloured fillers are not available or, in the case of TABU pre-dyed veneers whose colours are difficult to reproduce with oxides etc., a solution is to sand down a veneer of the same colour, and make up a filler with the wood dust so obtained. Insufficient drying or incompatibility between the filler's components and the varnishing products could cause marks of a different colour tone which will appear after varnishing.

Sanding: usually it is carried out with 100/150 grain sanding paper. Finer or coarser grains will result in greater or lesser absorption of the varnishing products and, respectively, in a more or less intense colour of the veneer. Worn sanding paper can cause burn-marks on the veneer by excessive friction (sander). In this case the friction of the abrasive produces heat (burn marks) and consequent colour variation. Excessive sanding causes over-reduction of the veneer's thickness, which reveals the part of the veneer in contact with the glue, causing the undesirable phenomenon of porewhitening or sanding through. For these reasons it is advisable to harmonise perfectly the action of the abrasive, pressure and sander speed, according to the veneer's characteristics.

Surface colouring: this is normally carried out using chromophores dissolved in water or solvent, or pigments suspended in a synthetic medium (nitrous-based, acrylic and so on). The application is carried out manually, using air sprays or a roller dyer. Such systems have their limits since it is not possible to obtain very transparent colours, and the surface veining is consequently not emphasised; in addition it is not possible to obtain the complete colour range, as the base colour of the wood affects the final tone obtained and there is not a complete penetration of the colourants; they exclude the possibility of applying veneers of various colours on the same substrate. Such methods therefore limit a modification of the base colour and oblige one to remain, broadly speaking, within the colour range of the veneer used. In the case of colouring with water-based colourants, drying presents additional problems. If it is not carried out perfectly, it will badly affect the varnishing product that is subsequently to be used. In mass production, it is difficult to reproduce the full colour range given that colours change during the cycle of production, according to the veneer's absorption capacity, the speed of dyeing, the evaporation of the solvent in the machines and the type of sanding previously carried out; these are considerations which affect the degree of colour penetration. The system of surface colouring is therefore acceptable when a good degree of transparency or constant colour reproduction is not required, and further sanding after colour application is not called for.

Colouring of the natural veneer in the rough state: (TABU System): by this method the veneer is dyed using special technology when it is still at the rough or pre-processed stage, that is before being applied to the substrate. The colourant therefore penetrates through the full thickness of the veneer itself whose treatment and application system, sanding and varnishing remain similar to those adopted for natural veneers.

Making good: where there are small sanding-through areas, the defect may be remedied (so far as possible) using the following means according to the case in point: alcohol felt pens, water or solvent-based colourants, colourants in solvents and nitrous-based resin or tempera-based pencils, bearing in mind that the final tone must be checked after the application of the varnishing product and ensuring there is no incompatibility between the paint product itself and the filler material. Stains or failure to dry of the paint product applied may result.

Resistance to light: all wood species are light sensitive and change their colour on exposure to strong sources of light; it is therefore common practice to protect the wood during storage as well as the cycles of production. Veneers are normally used to manufacture products for indoor environments, not subjected to negative environmental factors (strong light, bad weather, extreme variations of temperature); besides this, no wood is ever used in its rough state but is varnished; it is therefore the layer of varnish which has to protect the wood from light and physical, chemical or mechanical agents; it must not go yellow, it must protect the wood from light and it must be easily absorbed. The varnishing products on the market are very different according to the intended use; it is therefore advisable, in order to achieve good results, to make a precise selection of both the product and the varnishing process so as to avoid excessive colour variation or defects of various kinds.

Varnishing: at the varnishing phase, the wood colour becomes more intense according to the degree of penetration of the varnishing product used. A greater degree of penetration corresponds to a more intense colour; a specific final colour will result according to the degree of penetration, transparency, colour and opaqueness; changing the varnishing product or the varnishing cycle can result in the same veneer (natural, pre-dyed, multilaminar) achieving a different final colour-tone. The varnish layer can have a greater or lesser tendency to go yellow and this can cause colour changes. Yellowing is more noticeable on light coloured wood species (for example sycamore, pear, pine) while it will be less noticeable on dark coloured species or those which tend to yellow (walnut, mahogany, rosewood). All wood types when exposed to light will change colour. The changes vary from species to species. In the case of sycamore and walnut the change tends toward yellow; in the case of padouk towards red, in the case of pear towards brown and so on. Possible discoloration may occur to surface coloured wood, pre-dyed TABU or M.W. due to overstepping of the limits of resistance to light or to the heat of the colourants used (of whatever kind). It is always essential to use varnishes which do not tend to yellow and which contain additives to absorb ultra-violet light which help protect the wood against light bearing in mind that the varnish layer tends to act as a protection against light - a thicker layer means greater protection. While all the wood species, natural or dyed, pre-dyed TABU or multilaminar woods which are not varnished have little resistance, they can, by the use of appropriate varnishes, reach light resistance values determinate in conformity with UNI 9427 and depending on Xenotest according to UNI 11341: sycamore and similar 2-3, walnut and similar colours 3-4, mahogany and rosewood 4-5 (scale 0-5).

How to determine light resistance: to give a value of light resistance expressed in terms of "time" (1 month, 1 year and so on) is virtually impossible in that wood or manufactured articles which contain it are exposed to rays emitted from light sources which are not quantifiable and which vary according to the type, the intensity, the length of exposure and the environmental conditions. For example, rays of sunlight filtered through a glass window change intensity according to the degree of altitude, if it shines vertically rather than horizontally, if it is direct or reflected, and so on. The weather conditions should be kept in mind. It is not possible to establish a point of reference relating to rainy days as opposed to cloudy ones and so on. As for artificial light sources, such as sun lamps, halogen lights, neon and so forth, the argument is virtually the same, in that every light source emits a different kind of wave, either shorter or longer, and they are positioned at differing distances and angles from the manufactured item. The method of measuring light resistance according to the UNI 11341 or similar international standards, consists in subjecting a partially concealed substrate in a controlled environment (humidity and temperature, etc.) to exposure to one kind of light emitted from a particular light source for a predetermined time (20, 30, 40 hours and so on), and, on uncovering the concealed area, observing the tonal variations between the two parts which will be revealed. Thus a value which expresses resistance to light is obtained. As regards the methods referred to in the standards mentioned (UNI 11341 and UNI 9427), the values are expressed in a scale of 0-5 (0 = least resistance, 5 = greatest resistance).

Dyes: where it is desired to retouch the colour of a natural or pre-dyed veneer or M. W., water-soluble dyes can be used, applied by spray or roller, taking care that the moisture content of the veneer does not exceed 12% before the application of the varnishing product. Solvent-based dyes, with or without a binding agent, may be used, taking care that they should not alter the transparency of the veneer.

Woods with deep or marked pores: ash, oak, walnut, M.W. and so on. In the case of these woods where deep or marked pores occur naturally, it is as well to remember that incorrect filling of these pores with the varnishing product can cause "silvering" or "pore-whitening". Therefore it is essential to use low-viscosity (liquid) varnishes which are quite slow-drying, particularly for the first coat; this is to allow the varnish to penetrate deeply and to facilitate the release of the air contained in these deep pores.

Moisture content of wood: not above 12% at the time of varnishing.

Primers and finishing products: nitrous-based products, polyurethane, water-based acrylic and so on; in particular, on light and pastel-coloured woods, use non-yellowing products with ultra-violet absorbing additives.

Protective film: on dyed woods or M.W., use a non-yellowing protective layer for light-coloured woods; avoid using protective layers for dark woods on light colours. Protective layers for dark woods are used to create a film on particularly oily woods (such as rosewood, teak, etc.) during the process of applying polyester. Non-oily wood species (such as mahogany, anegre, tulip, birch, sycamore and so on), pre-dyed TABU or woods treated with water-soluble dyes or solvent based colourants, may be varnished by polyester processing, without being treated with a protective layer. However, it is advisable to apply such a layer to avoid possible incompatibility between the polyester (peroxide) and some types of colourants. Such incompatibility may cause colour changes, for example the colour combination redblack- orange in which the red is incompatible, results in loss of red in the base colour. Always use protective layer products which dry fairly slowly to avoid pore-whitening.

Naturally-dried polyester: on light or pastel colours use clear polyester paraffin varnishes which do not tend to turn pink or green, and which do not cause opalescence or stains on drying.

Varnishes for ultra-violet ray drying: use products which do not alter the wood colour and which limit as far as possible U. V. ray exposure, which brings about colour changes. In the varnishing process, before drying, the pores of the wood must be completely filled with the varnishing product which in this way replaces the air in the pores. This procedure is sometimes compromised by work practices which seek to accelerate the production cycles and to limit the amount of varnishing product used. In the U. V. drying process there are very short drying times. If you change the relationship between the machinery speed, paint quantity and light intensity, the varnishing product improperly or unsuitably applied will not penetrate or adhere sufficiently and as a consequence, pore-whitening, opalescence, white stains and blisters etc. will result.

Re-varnishing: it is sufficient to remove the layer of varnish by sanding and to get back to bare wood and start the new varnishing procedure. Again in the case of colour changes caused by exposure to light or an inappropriate varnish layer, by sanding thoroughly the wood will return to its original colour.

Note: as regards U. V. drying varnishes, it is not possible to add U. V. ray absorbers since they inhibit the drying process. This factor makes these products less efficient as regards protection of the wood against light.

These recommendations are solely the result of Tabu's experience and therefore not binding. It is up to the users to evaluate their usefulness based on their own experience, on the technical production cycles and the result which is desired.

TABU is always on hand to deal with any of their customers' requirements to solve problems or find new solutions, whether to do with colour, wood species, texture or appropriate technology to be applied.

