

BONDING OF EXOTIC WOODS (PK 12)

WHAT IS EXOTIC WOOD?

The term exotic wood, or also tropical wood, goes back to the origin of most exotic woods, the tropical rainforest. Since the term tropical wood is often mistakenly associated with predatory logging, the term is rarely used. Irrespective of the fact that tropical wood, or exotic wood, is meanwhile almost exclusively harvested and used from sustainable and conventional forestry for parquet flooring of all kinds, the term exotic wood has established itself in the flooring industry. The corresponding certificates are available from reputable manufacturers on request. In addition, domestic timbers are partly also counted as exotic woods today due to their special properties in terms of colour, strength and constituents.

EXOTIC WOOD AS PARQUET FLOORING

Exotic woods are increasingly being used in parquet flooring, albeit on a small scale, mainly because of their striking grain and expressive colour. In addition, the variety of hardness, colour and density, as well as the often low degree of swelling and shrinkage, predestines exotic wood for this purpose. Due to the strong variations in grain and colour tones, exotic wood and domestic wood species are graded by DIN EN 350-2 into different durability classes. A further distinction is then made between the species by their resistance to wood destroyers (e.g. insects, fungi, termites, marine wood pests). Timbers such as teak have good durability against woodrot but this is not true for birch in the long term. Due to their high resistance and/or durability, many exotic wood species are also recommended and used outdoors.

Various exotic wood parquet types are available. As solid parquet, exotic wood is available as strip parquet, 10-millimetre lamparquet, mosaic parquet, as upright parquet fingers, wide fingers and in plank form - as a multi-layer construction (wearing layer as exotic wood with different types of joists) as multi-layer parquet, including as two-layer and three-layer parquet.

WOOD CONSTITUENTS

Wood consists mainly of cellulose and lignin, but depending on the growth area, soil type, weather and weather influences, wood species also contain resins, oils, greases, waxes, tanning agents, minerals, sugar, salts, acids etc. In addition to physical, chemical and mechanical properties, this also results in odour, colour, shrinkage, drying behaviour and corresponding processing, bonding and surface treatment.

NOTES ON BONDING EXOTIC WOOD PARQUET

Despite many positive technical properties, solid exotic wood parquet also has various, sometimes unfavourable, properties which the parquet layer should take into account. Multi-layer parquet types usually have counter layers that are easy to bond and therefore rarely pose a problem for bonding. In the case of solid parquet types or direct contact between exotic wood and adhesives, such as multi-layer elements with a backing of the same type of wood, the focus is directly on the properties of the exotic wood.

- ✓ The best obtainable connection to wood, but also to screed, uses so-called hydrogen bonds. Ideally, the adhesive bonds with the OH groups of the wood and the screed either by adsorption or by a chemical reaction.
- ✓ Adsorption is achieved with dispersion adhesives, as the resin particles on the surface contain OH groups that can bond to wood and screed.
- ✓ With silanised adhesives such as STAUF SMP or SPU adhesives, a direct chemical reaction takes place with the OH groups in the wood and screed. In the process, methanol is split off in minimal quantities and a stable network is formed.
- ✓ Polyurethane adhesives (STAUF PUK types) also react directly with OH groups via the isocyanate group. One-component adhesives form CO₂, which results in slight foaming, and can be used to avoid cavities. In two-component adhesives, the OH groups from the resin and the isocyanate groups from the hardener react with each other, while there is always a slight excess of hardener that reacts with the wood and screed.
- ✓ Bonding problems can occur above all if the wood contains large quantities of salts and oils or waxes. Salts are the biggest problem here, as they can reduce formation on the OH groups. Oils and waxes are now less problematic due to the use of reactive adhesives (SMP and SPU or PUK types). However, the adhesion of the SMP and SPU types greatly depends on the type and quantity of oils and waxes present.
- ✓ Different types of parquet place different demands on the installer. It is therefore advisable to consult the relevant technical data sheet. Detailed information is available at <https://www.stauf.de/info-center/technische-informationen/>.
- ✓ Suitable parquet adhesives for the various parquet types can also be found in the product overview table of parquet types in the STAUF catalogue or on our website <https://www.stauf.de/service/downloads/>.

TECHNICAL DATA SHEETS

- ✓ Various exotic woods such as Cumarú or Olive have a so-called "irregular twist" which, depending on the wood grade and moisture absorption, can result in individual, solid strips twisting and lifting out of the fresh adhesive bed. Please do not use water-containing or water-soluble adhesives such as M2A types for these exotic woods.

DIFFERENT TYPES OF WOOD AND THEIR SPECIALITIES IN BONDING

Some exotic wood species have special requirements relating to adhesives due to different constituents and growth properties. These are some examples:

- ✓ Cumarú: This is a very hard, dense and oily wood, which greatly reduces the bonding capacity of adhesives. For this reason, the bonding capacity of dispersion adhesives is inadequate, since the dispersion particles neither penetrate into pores nor can guarantee good wetting of the surface due to the high oil content. However, these properties make the wood extremely durable.
- ✓ Doussie/Afzelia: When bonding Doussie, it is necessary to be very careful, not because it is difficult to bond, but because many different species of Afzelia from various parts of Africa are meanwhile sold as Doussie and differ in part greatly in their degree of swelling and shrinkage. The wood species is generally very stable in resisting pests and environmental influences, and therefore well suited for outdoor use. A disadvantage of this stability is that the wood is very difficult to stain and dye. In addition, the wood can become discoloured and flecked when exposed to UV light.
- ✓ Ipe/Lapacho: This South American wood is rich in oils and fats, which do not damage the adhesives used, but ensure slower setting, especially with SMP and SPU adhesives. In addition, the high density of the wood, in addition to its difficult bonding characteristics, make it much harder to process. The best results are achieved with 1C- and 2C-polyurethane adhesives.
- ✓ Merbau: It is a wood that mostly originates from Indonesia, which can be described as "calm" due to its slow moisture change time, and its great hardness and durability. Its constituents can occasionally cause skin irritations. In addition, the surface treatment is impaired by light flecks in the wood, which are greatly pronounced when varnish is applied. Merbau can be bonded very well with all the adhesive types tested.
- ✓ Sucupira: As with the Doussie, the name Sucupira is now also an umbrella term for different types of wood with different properties. Actual sucupira comes from South America and has partly greasy ingredients that make adhesion difficult. In addition, the wood is very hard and durable. Saws and sanders should be fitted with appropriate extraction devices to avoid irritation of the skin and the respiratory tract. Very good adhesive results are obtained also in combination with 1C- and 2C-polyurethane adhesives.
- ✓ Teak: When processing teak, care and protective precautions must be taken, especially when sawing. The constituents can have harmful effects on the skin and respiratory tract. The fats and oils contained in the wood also adversely affect adhesion. It cannot be ruled out that oils and/or greases, for example, become deposited on the adhesive surfaces at elevated temperatures. In addition, most of the wood today comes from afforestation and therefore often has had less time to grow. The quality can therefore fluctuate. Two-component polyurethane adhesives are particularly suitable for bonding.
- ✓ Wenge: Places only low demands on bonding, but quite high demands on paints and oils, as mineral components are often included in addition to other ingredients. Wenge can also fade over time. It is a dimensionally very stable and robust wood with long moisture change times and only a few wood constituents that influence adhesion.

TECHNICAL DATA SHEETS

In order to determine how well the individual adhesives adhere to the wood species, each wood species was bonded with different types of adhesive and subjected to shearing after certain periods of time. For this purpose, parquet fingers on which a defined area and layer thickness was wetted with adhesive were used. The shear test was carried out on a testing device with a defined speed in accordance with ISO 17178 ("Adhesives - Adhesives for bonding parquet to subfloor - Test methods and minimum requirements"), see table on page 4.

CONCLUSION

Successful bonding of exotic woods is very possible in particular using reactive adhesives. STAUF PUK 4SPEED, STAUF PUK 446 and STAUF PUK 455 are particularly noteworthy in this respect. In addition to very good adhesion, they also have ideal (hard or hard-elastic) mechanical properties. Although it is possible to use dispersion adhesives with many types of wood, the water content of this type of adhesive limits the areas of application, and therefore bonding of small-format types of parquet such as mosaic parquet or industrial parquet is recommended. If exotic wood is to be bonded, not only the type of wood, but also the type of parquet used plays a decisive role in selecting the most suitable adhesive. Not only the above table should be consulted, but you should also take into account the additional technical data sheets, the table showing parquet type to parquet adhesive combinations in the STAUF catalogue as well as your own expertise. You can also, of course, obtain advice from a STAUF technical department about your particular project. Once all parameters have been clarified, nothing more will stand in the way of successfully bonding exotic wood-parquet flooring.

The information provided above corresponds to the current status of development. The information is purely indicative and non-binding, since we have no control over the laying process and because the actual laying conditions on site vary. Thus no claims can be made based on this information. The same is true for the commercial and technical advisory services that are provided without obligation and free of charge. We therefore recommend carrying out sufficient testing of your own in order to determine whether the result is suitable for the intended purpose.

TECHNICAL DATA SHEETS

In the overview, you will find a selection of our most suitable products:

Adhesion to exotic woods	Differential radial shrinkage in % ⁽¹⁾	Differential tangential shrinkage in % ⁽¹⁾	Moisture change time ⁽¹⁾	SPU 570	SPU 460	PUK 446	PUK 455	PUK 4SPEED	SMP 950	M2A 720
Ybyraro/Amendoim	0.25	0.40	n.a.	✓	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Acacia / Yellow Locust steamed	0.24	0.35	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Bamboo	0.15	0.15	slow	✓	✓	✓✓	✓✓	✓✓	✓	✓
Cabreuva	0.4	0.9	fast	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Cumarú	0.29	0.44	fast	✓	✓	✓✓	✓✓	✓✓	✓	✗
Doussie/Afzelia	0.11	0.22	slow	✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓
Eucalyptus	n.a.	n.a.	n.a.	✓	✓	✓✓	✓✓	✓✓	✓	✓
Thermo Ash	0.17	0.27	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Garapa	0.2	0.38	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Ipe/Lapacho	0.25	0.41	slow	✓	✓	✓✓	✓✓	✓✓	✓	✓
Jatoba	0.25	0.48	medium	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Iroko Kambala	0.19	0.28	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Kempas	0.29	0.37	n.a.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Black cherry	0.18	0.31	medium	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Massaranduba	0.33	0.44	n.a.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Merbau	0.17	0.27	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Missanda / Tali	0.14	0.25	n.a.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Muiracatiara/ Tigerwood	0.22	0.36	n.a.	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓
Walnut (European)	0.18	0.29	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Olive tree	0.10	0.17	medium	✓✓	✓	✓✓	✓✓	✓✓	✓	✗
Padouk	0.18	0.27	n.a.	✓	✓	✓✓	✓	✓	✓	✓
Panga Panga	0.20	0.38	slow	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Rosewood	0.24	0.37	medium	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Smoked Oak	0.16	0.36	slow	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Sucupira	0.23	0.35	slow	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Teak	0.16	0.26	slow	✓	✓	✓✓	✓	✓	✓	✓
Wenge	0.22	0.34	slow	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓

(1) Shrinkage and moisture change time have been researched from many sources and partly interpolated.

Key: ✓✓ Well suited ✓ Suitable ✗ Not suitable