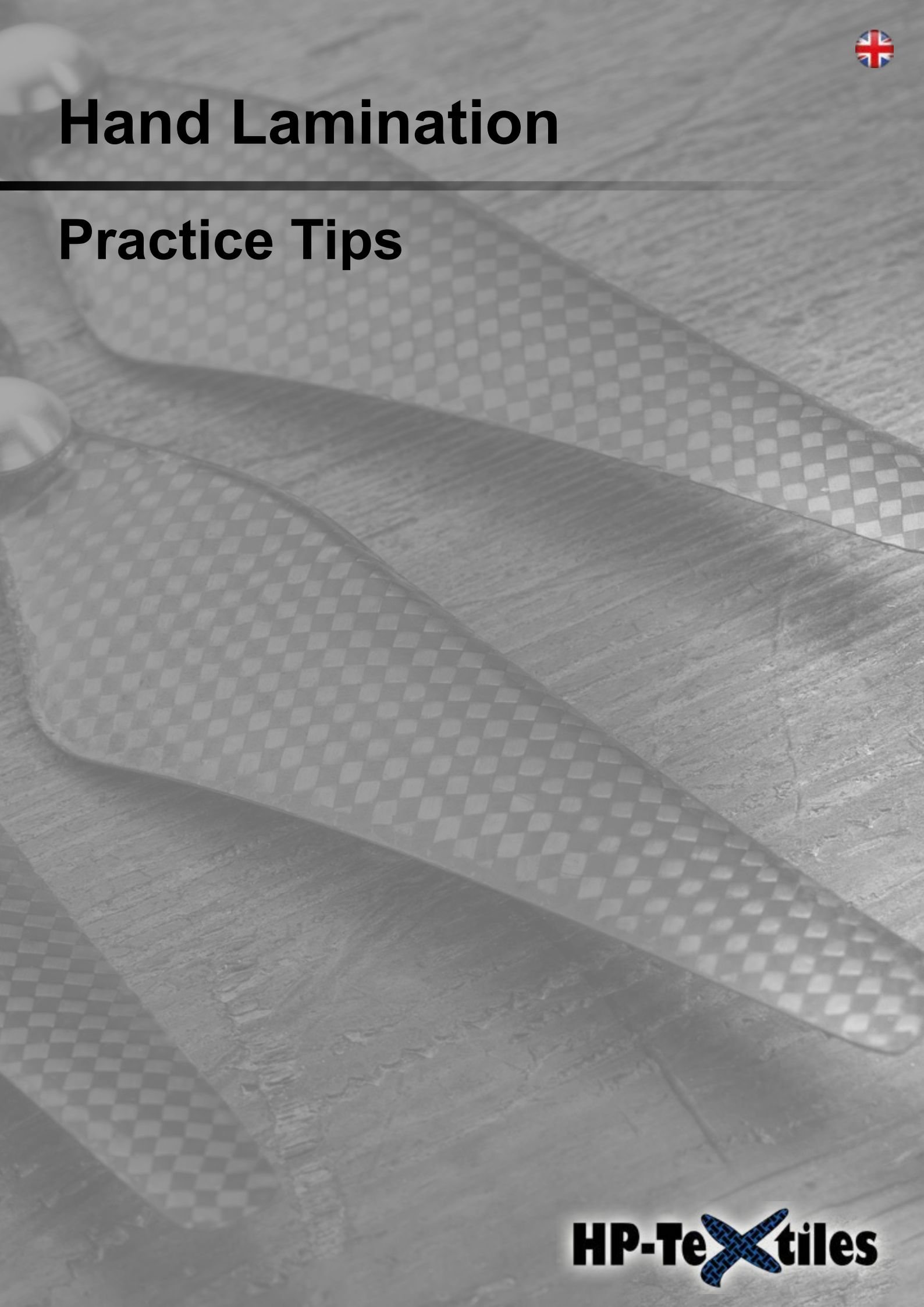
Hand Lamination

Practice Tips



HP-Textiles

Hand lamination
- Basics and materials -

The background:

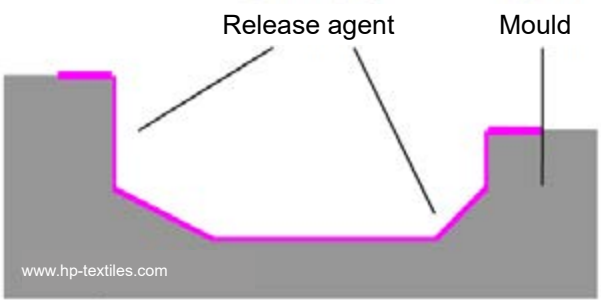
The hand lamination process is particularly suitable for the production of small to medium quantities. It is characterized by moderate investment costs due to its low technical complexity. In addition to private applications, most boats, wind turbine blades, containers, prototypes and model airplanes are still produced using this process today. In hand lay-up, the reinforcing fibers (glass, carbon and/or aramid fibers) are rolled or pressed into a synthetic resin matrix. This is often done in a mold so that a component is designed at the same time. Epoxy and polyester resins are generally suitable for hand lay-up.

These instructions refer primarily to working with epoxy resins on a smaller scale, e.g. in model making. For all work, the ambient temperature should be 20°C and the room humidity approx. 60%.

The preparations:

First, the mold is cleaned and degreased with acetone (HP-AC) or XB thinner.

The build-up of the release layer can then be started on the cleaned surface. A priming wax (HP-G) is first applied to slightly porous / absorbent surfaces. After drying (approx. 5-15 minutes*), the HP-PVA film release agent (drying time approx. 5-10 minutes*) is then applied with a sponge or soft brush.



This combined release layer structure is particularly safe, as demolding takes place between the two release agents and not at the component level. Residues of the HP-PVA film release agent can simply be washed off with warm water. If the substrates are absolutely smooth and sealed, HP-BM17 release agent can also be used as an alternative. This is a convenient liquid wax-based release agent that is applied in several coats and polished out, applied in several layers and polished out.

►Please also refer to our release agent decision aid or the respective data sheets for details.

Which top coat resin?

If a relatively liquid topcoat resin is to be applied thinly, it is also referred to as a fine-layer resin. This can be the case, for example, in model making or for smaller components. Application thicknesses of well under 0.5 mm are sufficient here, although this can vary depending on the resin system.

For surfaces subject to greater stress (chemical protection, high mechanical loads), the top coat is applied in the form of a gelcoat. This is significantly more viscous (= thicker) than a fine layer resin and is applied up to a thickness of 1 or 2 mm. The top layer can be individually colored with color pigments if required.

►Details on mixing can be found in the respective data sheets and our processing instructions for epoxy and polyester resins.

* All data refer to 20°C room temperature and 60 - 70% room humidity.

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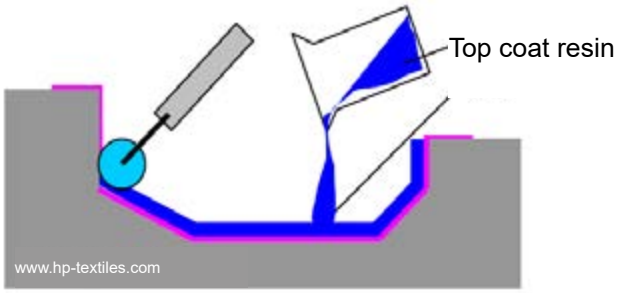
Apply the top coat:

Once the separating layer is completely dry, the top coat resin can be applied. It forms the subsequent surface and should be applied carefully and relatively thinly.

Topcoat resins have particularly pronounced surface properties compared to laminating resins. For example, in addition to scratch resistance, UV resistance is also significantly better.

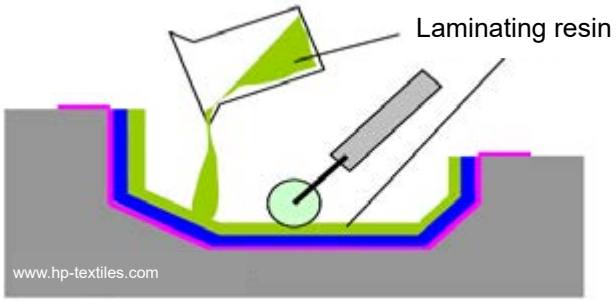


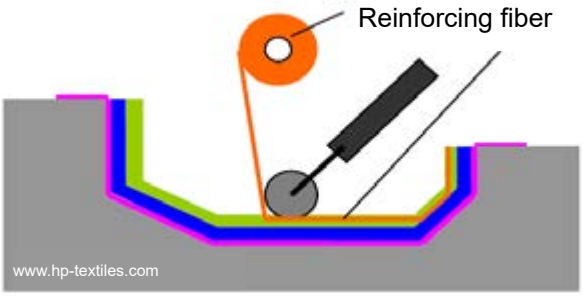
Laminating:

When the surface is gelled, some laminating resin is applied. In this state, a better bond with the top layer is achieved. In this case, gelled means that the viscosity has increased significantly and the resin reacts increasingly viscously on contact.

The glass fibers are now laminated into the laminating resin wet-on-wet. This should always be done in layers using a deaeration roller and starting from the center in order to drive out bubbles.

In addition to deaeration, a deaeration roller ensures better compaction of the individual layers. In general, the reinforcing fibers should be aligned in the direction of the load, starting with a light material so that no imprints of coarse structures appear in the top layer resin later.





Sharp corners and edges should be lined with a mixture of resin, cotton flakes (HP-BF1) and/or microballoons (HP-MB2) on the top layer resin.For larger edges or component sections, glass fiber chips (HP-GS6) can also be stirred into the resin. This allows these edges to be filled in advance, as the restoring force of the fabric can otherwise lead to detachment and thus to the formation of bubbles under the glass fibers.Particularly stressed areas can be reinforced with carbon, aramid or hybrid fabrics.For example, it has proven useful to incorporate hybrid fabric (= mixed fabric of aramid and carbon fibers) in sections subject to high mechanical stress (e.g. kayak hulls, landing gear parts in model airplanes).

Properties of the reinforcing fibers

Carbon
- low specific weight
- high stiffness
- electrically conductive

Aramid
- very high tensile strength
- resistant to chemicals
- good impact & abrasion resistance

Hybrid Carbon/Aramid
- combine good properties
- high rigidity & compressive strength
- impact resistant & wear resistant

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Revision: 02/2024

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The peel ply:

Before curing at room temperature, a nylon peel ply can be applied to the still wet surface. After curing, this is torn off („peeled off“) at an acute angle, leaving an evenly roughened surface that can be bonded without further treatment, for example. In addition, the peel ply absorbs excess resin and thus improves the fiber volume content, i.e. the „power-to-weight ratio“ of the subsequent component.

If it is not possible to work wet-on-wet, a peel ply can also be used here. Due to the rough surface structure, this creates a good bond with the next layer without the need for lengthy sanding work!

The curing process:

This is significantly influenced by the temperature and varies depending on the resin system. For details, please refer to the data sheets of the respective resin systems. We recommend a temperature of 20°C at 60-70% humidity for the working areas.

After curing at room temperature, the components can be extra tempered („baked“). Here, a precisely defined temperature is maintained for a certain time (e.g. 15h at 60°C), which leads to residual cross-linking of existing reaction partners in the resin system. This results in improved heat resistance and higher component strength.

You are welcome to use our selection aids to help you choose the right product.
These can be found in our online store under „Instructions > Decision-making aids“.
Or conveniently via these QR codes:

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Revision: 02/2024

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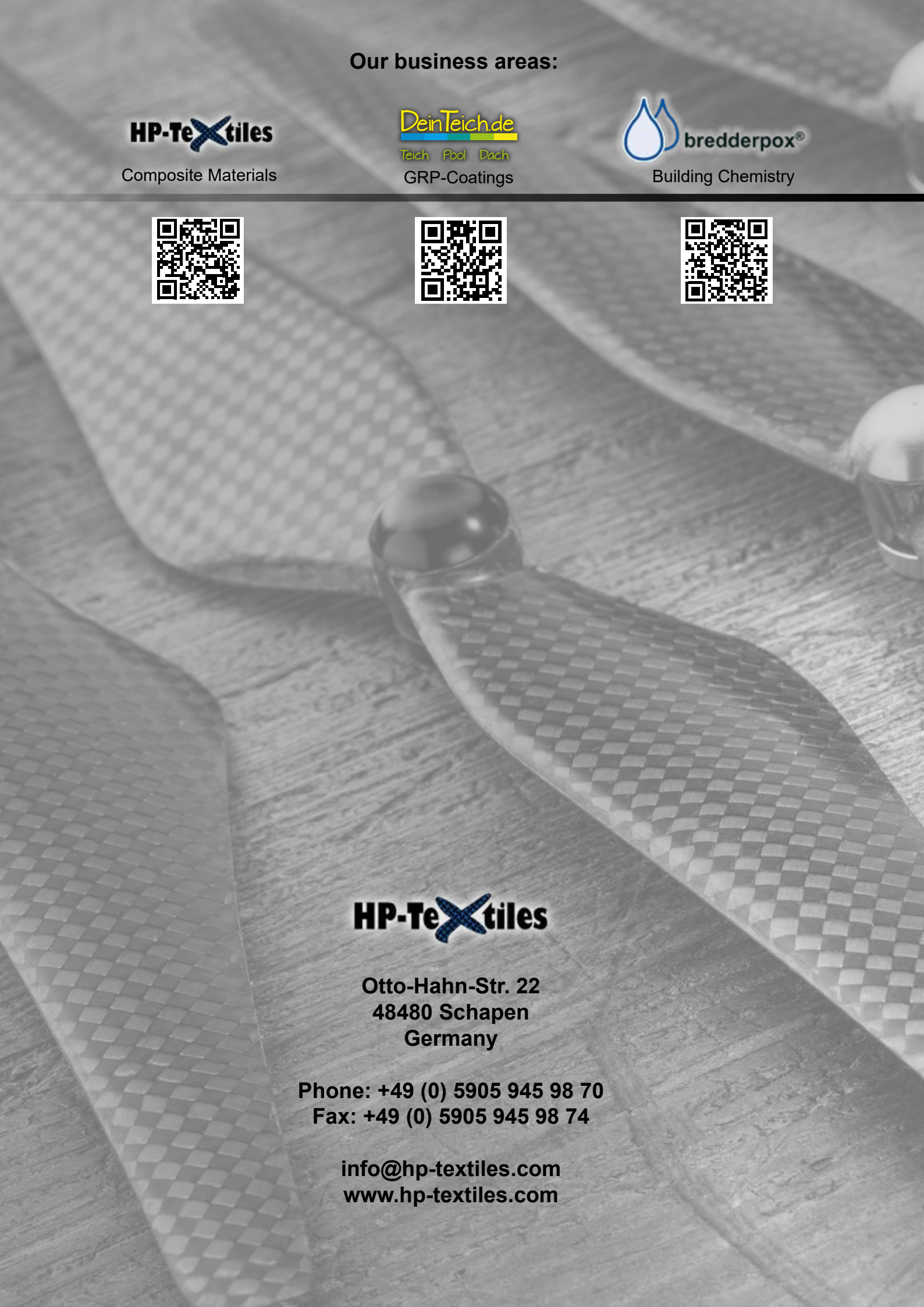

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