UV light Curing

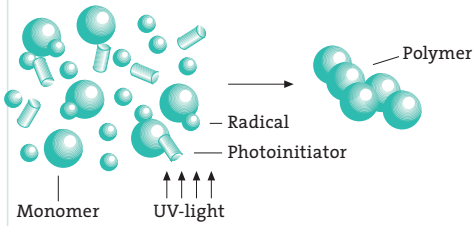
Brandenburger pipe liners are available for all diameters (circular: DN 150 to DN 1000; egg-shaped: 200/300 to 800/1200) and are cured using UV light. Special light initiators in the resins react to UV light at specific wavelengths. Since 1993, this procedure has been used around the world to safely and permanently rehabilitate sewers.

Brandenburger combines duroplastic resin with reinforcing glass fibre composite to manufacture seamless liners. With UV light curing, it is crucially important to choose the right materials. The optical refraction index is an important parameter since it specifies how the material refracts the incoming light. ***The quality of the liner material, resins, and UV light technology and their interplay with each other are the keys to the success of this method.***

Light curing

UV light curing has been used for many years in industrial applications such as paint curing in the automotive industry. This curing technology has also been used for sewer rehabilitation since the end of the 1980s.

Light curing of resins requires free radicals to induce the polymerisation. Exposure to UVA light causes these photoinitiator molecules to decompose into radicals that are then used for polymerisation. These induce the polymerisation process by interlinking with the styrenes contained in the resin. For this, special photoinitiators are added to the resins, which decompose into colourless products when exposed to UV light.



Resins

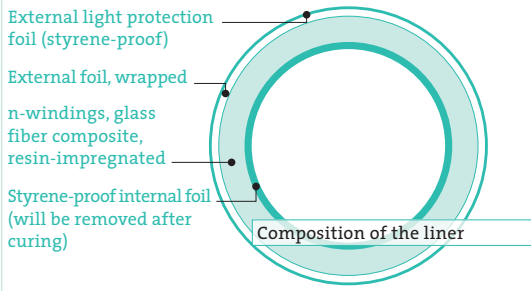
Brandenburger has successfully used unsaturated polyester resins (UP resins) and vinylester resins (VE resins) in sewer rehabilitation projects for many years already. In general, GFRP composites are impregnated with UP resin (DIN 18820 group 3, type 1140 or EN 13121 group 4) for municipal sewers while a special VE resin (DIN 18820 group 5; type 1310 or EN 13121 group 7A) is more appropriate for aggressive industrial sewage applications.

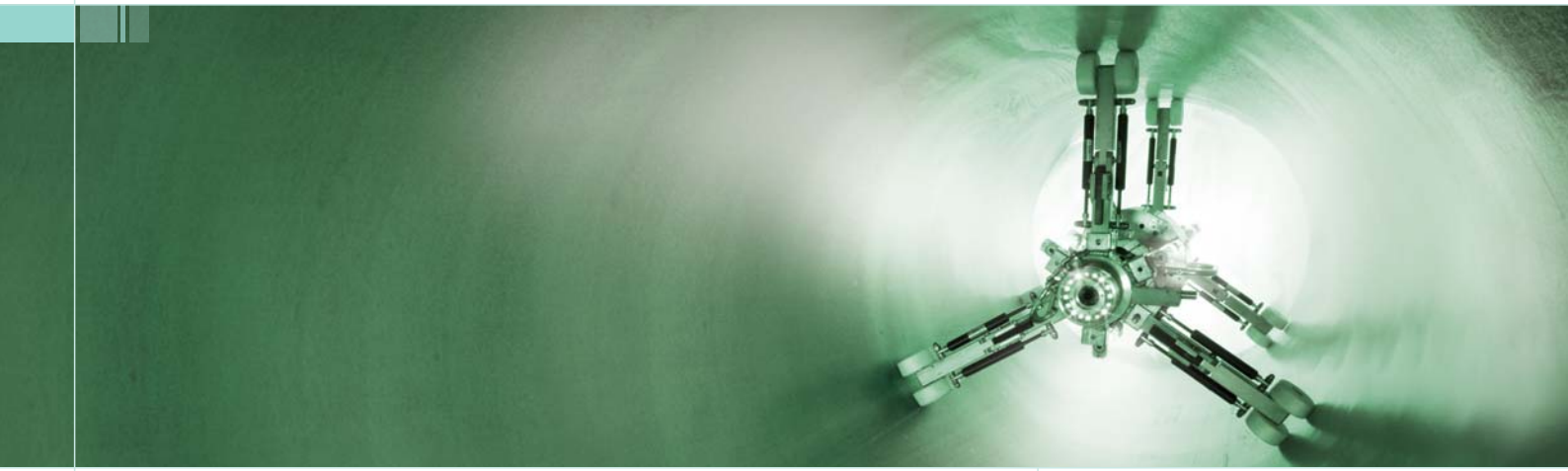
The reactive resin material is manufactured by Brandenburger according to a customised procedure with consistent quality. Similarly, we use a customised and patented procedure to infuse the resin into the seamless glass fibre composite with a high degree of homogeneity. Thus, the UV light source is able to cure the liners evenly and in a controlled manner.

Glass fibre composite

Brandenburger liners utilise a special glass composite consisting of high-quality E-CR / Advantex® glass fibres. The homogeneous base material we have developed has a high optical refraction index that, together with the special resin mixture, allows the liner to cure evenly. This is an advantage of Brandenburger liners over sandwich-type liners or liners using synthetic fibres as the base material.

The high transparency of the resins, glass fibres, and foils used in the Brandenburger liners establish the required conditions for even curing.





Technical equipment

In addition to the glass fibre composite used and the resin composition, the UV light-curing equipment is the third crucial factor affecting the quality light-cured GFRP inliners. The most important criteria are the intensity and duration of the light exposure. For this reason, Brandenburger founded its UV Reline.tec GmbH & Co. KG subsidiary in the 90s as engineering firm specialised in UVA design.

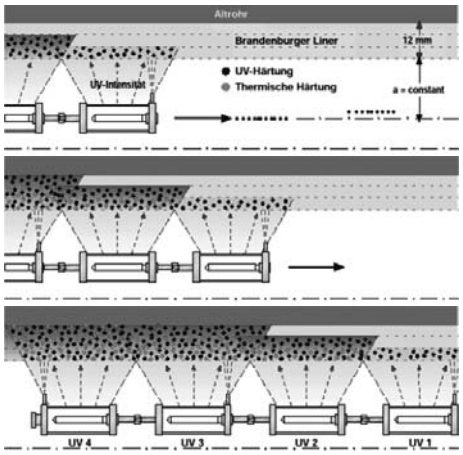
In recent years, UV light technology has been constantly improved to provide safe and reliable curing processes. It is important that the radiation intensity of the UV lamps is maintained as constant as possible in a wavelength range between 360 and 420 nm throughout their entire service lives. One also needs to ensure that UV lamps are optimally placed in the liner during the curing process so that the liner is evenly exposed – also for varying channel diameters and line profiles.

Hybridliner® with combination curing

It has been shown that this perfectly tuned system allows wall thickness of up to 10 mm to be reliably cured using only light. This covers the majority of diameters used. For larger wall thicknesses as with large egg-shaped profiles, UV light curing alone would be too slow and therefore uneconomical. For these applications, Brandenburger has developed Hybridliner® and used it successfully since the year 2000.

Here, the light-curing resins are mixed with a small amount of heat-curing peroxides. Thus a combination of light and heat-curing is used but without the need for additional heat from steam or hot water. Exorthermic reaction temperatures between 80 and 130°C are achievable during the UV-curing process. This induces heat curing in addition to light curing so that even liners with large wall thicknesses will be cured. Brandenburger Hybridliner® can be used to rehabilitate sewers of any wall thickness. The curing speeds are similarly fast even for this procedure.

Hybridliner® curing method



Fastest curing

Wrapped in an external UV-light-proof foil, the liner is prefabricated for construction site requirements and can be stored for long periods.

The advantages of the resin-glass-fibre composite developed by Brandenburger are most apparent for on-site curing with significantly improved curing characteristics compared to other materials.

The perfect interplay between the liner technology, resin system and UV light technology allows curing speeds of up to 100 m/h.

UV light technology provides an optimal and controlled light-curing process. The entire process is electronically controlled, monitored, and documented. The most important parameters here are recording the ignition times, the number of lit lamps, curing start and end times, internal liner air pressure in mbar, curing speed in cm, the resin reaction temperature and displaying the travelled path. After completing the sewer rehabilitation project, the contractor receives complete machine-generated documentation.

Conclusion

The Brandenburger liner system utilises GFRP compound materials in combination with UV light-curing to provide long-life liners with material characteristics optimally tuned to sewer rehabilitation.

The procedure has been approved by DiBt since 2001.

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