

## Thermoplastic Lining

### General

For precast concrete pipes in sewer applications it is an essential requirement to protect the inside surface. The protection of the inside surface is necessary to ensure water proofing, good flow characteristics and high chemical resistance.

Past experience has shown that unprotected concrete surfaces as well as chemical based linings such as coatings, sprayed linings are not providing the life duration which is required for such investment intensive life lines for cities and industrial installations.

Lining with thermoplastic material which is based on mechanical bonding in the concrete substrate is providing much superior properties for such applications. This report will discuss the main benefits of such linings and various methods of construction.

### Advantages of Thermoplastic Lining

Thermoplastic lining based on already widely used material such as **High density polyethylene (PEHD)** is applied to the concrete substrate during the construction of the system. This provides major advantages over other lining systems.

- Immediate implementation of the lining material ensuring better bonding capabilities and faster construction cycles (coatings can only be applied after concrete is completely dry and clean which will increase construction time)
- Mechanical anchoring by means of anchor studs which are applied on the thermoplastic liner during manufacturing provides high bonding strength between the lining material and the concrete (high pull out strength and ground water pressure resistance)

Thermoplastic lining provides further major advantages for such kind of applications such as:

- **Full leak tightness**

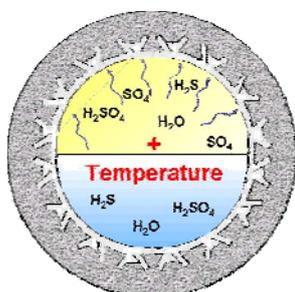


The material has excellent mechanical properties including high elongation behaviour. These properties provide in the application the benefit that cracks of the concrete structure will not create a leak of the lining material. Cracks of the concrete substrate will be bridged. The picture shows destructive tests performed on CPL lined concrete pipes where this behaviour of the lining material is demonstrated.

- **Very good chemical resistance**



Unprotected concrete structures are heavily deteriorated by chemical attack resulting in many cases that the structures are collapsing or heavily leaking. Similar behaviour is also happening on coated concrete structures whereby the lifetime is slightly higher than for unlined systems. Especially in regions where environment temperatures are consistently higher than 25 °C chemical resistance of concrete structures play a significant factor for the life time of the system.



Thermoplastic materials such as PEHD are chemically resistant against diluted solutions of salts, acids and alkalis if these are not strong oxidizing agents. Good resistance is also given against many solvents, such as alcohols, esters and ketones. This ensures that thermoplastic systems are not deteriorated by any chemical attack of long periods and will therefore play a significant factor for the long life duration of sewer systems.

- **Very good abrasion resistance**

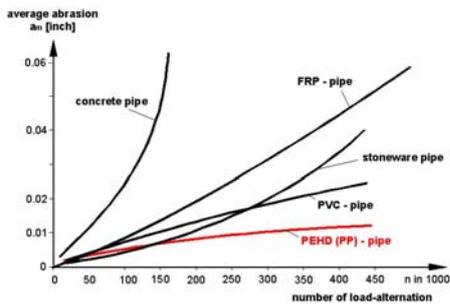
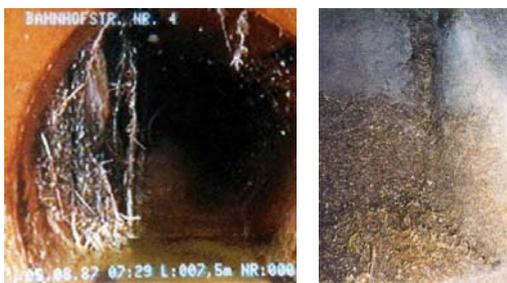


Figure 1: Comparison of the abrasion of Polyethylene (PEHD) & Polypropylen (PP) with other materials, tested acc. "Darmstädter" test method

Unlined concrete surfaces do not have very good resistance against abrasion. In operation this will create pretty fast deterioration of the installed system. Reduced flow capabilities, build up of sediments in the tunnel have been detected in many occasions. Abrasion tests have verified that various material types do provide very different properties. As the best materials, thermoplastic materials such as PEHD have by far the highest abrasion resistance.

- **very good resistance against root growth**



Unlined or uncoated surfaces do not provide resistance against penetration of roots. Especially joint sections showing such problems. The growth of roots into piping system will cause reduction of the static condition of the installed underground system and is causing significant reduction of flow capability. Cracks which are leading to leaking require significant efforts in maintenance, causing high operation cause downtime periods in operation.

- **Good surface smoothness**



Quelle: MPA Karlsruhe

Plastic lining provides the further bid advantage of very smooth surface characteristic. The above given properties and benefit of plastic ensure also that the surface properties remain consistent for the service life. A further advantage is that cleaning of the system does not require a lot of effort and is possible up to 120bar.

- **Settlements**



Quelle: MPA Karlsruhe

For pipelines settlements must be considered in weak soil conditions which can cause cracks or joint problems. Thermoplastic liners can take settlements by its high elongation properties.

**Long-term analyses based on actual testing also identified that PEHD lined surfaces are suitable to withstand life durations more than 100 years.**

The SURE GRIP CPL System meets the requirements of national and international standards. National approvals are qualifying this system for the application for precast pipes for the transport and storage of drinking and waste water.



Österreichisches Normungsinstitut  
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