

Material	Main Properties	Advantages	Disadvantages
HDPE Liners	Thermoplastic polyethylene, high resistance to acids and H ₂ S. Impermeable, flexible, durable. Preformed liners/sheets [1].	High corrosion resistance. 50+ year lifespan. Seamless when fused. Flexible, low maintenance.	High installation cost. Hard to retrofit complex shapes. May need reinforcement. Limited aesthetics.
Epoxy Coatings	Bisphenol-A/F or novolac epoxy, amine hardeners. Thin (2–10 mils) or high-build (10–30 mils+). High chemical/abrasion resistance [2].	Cost-effective for retrofits. Strong adhesion. Resists sewer chemicals. Zero VOCs (100% solids).	UV degradation without topcoat. Long curing (hours–days). Low flexibility. Needs surface prep.
Polyurea Coatings	Aliphatic (UV-stable) or aromatic isocyanates, amine hardeners. High chemical/abrasion resistance. Fast curing (seconds–minutes) [3].	Fast curing, less downtime. Flexible, crack-resistant. Aliphatic resists UV yellowing. Durable.	Costly, needs spray equipment. Moisture-sensitive application. Aromatic yellows under UV.
Polyurethane Coatings	Polyisocyanate with polyol hardeners, aliphatic (UV-stable) or aromatic. High abrasion/chemical resistance. Flexible or rigid [4].	Flexible, impact-resistant. Aliphatic UV-stable. Versatile for pipes/manholes. Good topcoat.	Longer curing than polyurea. Moderate cost. Aromatic yellows under UV. Moisture-sensitive curing.

References

[1] Najafi, M., *Sewer Pipeline Rehabilitation and Trenchless Technologies*, Water Environment Federation, 2013.

[2] Flick, E. W., *Epoxy Resins, Curing Agents, Compounds, and Modifiers: An Industrial Guide*, 2nd ed., William Andrew, 1993.

[3] Primeaux, D. J., *Polyurea Elastomer Technology: Chemistry, Properties, and Applications*, PDA Polyurea Development Association, 2004.

[4] Wicks, Z. W., Jones, F. N., Pappas, S. P., *Organic Coatings: Science and Technology*, 3rd ed., Wiley, 2007.