

GENERAL INFORMATION

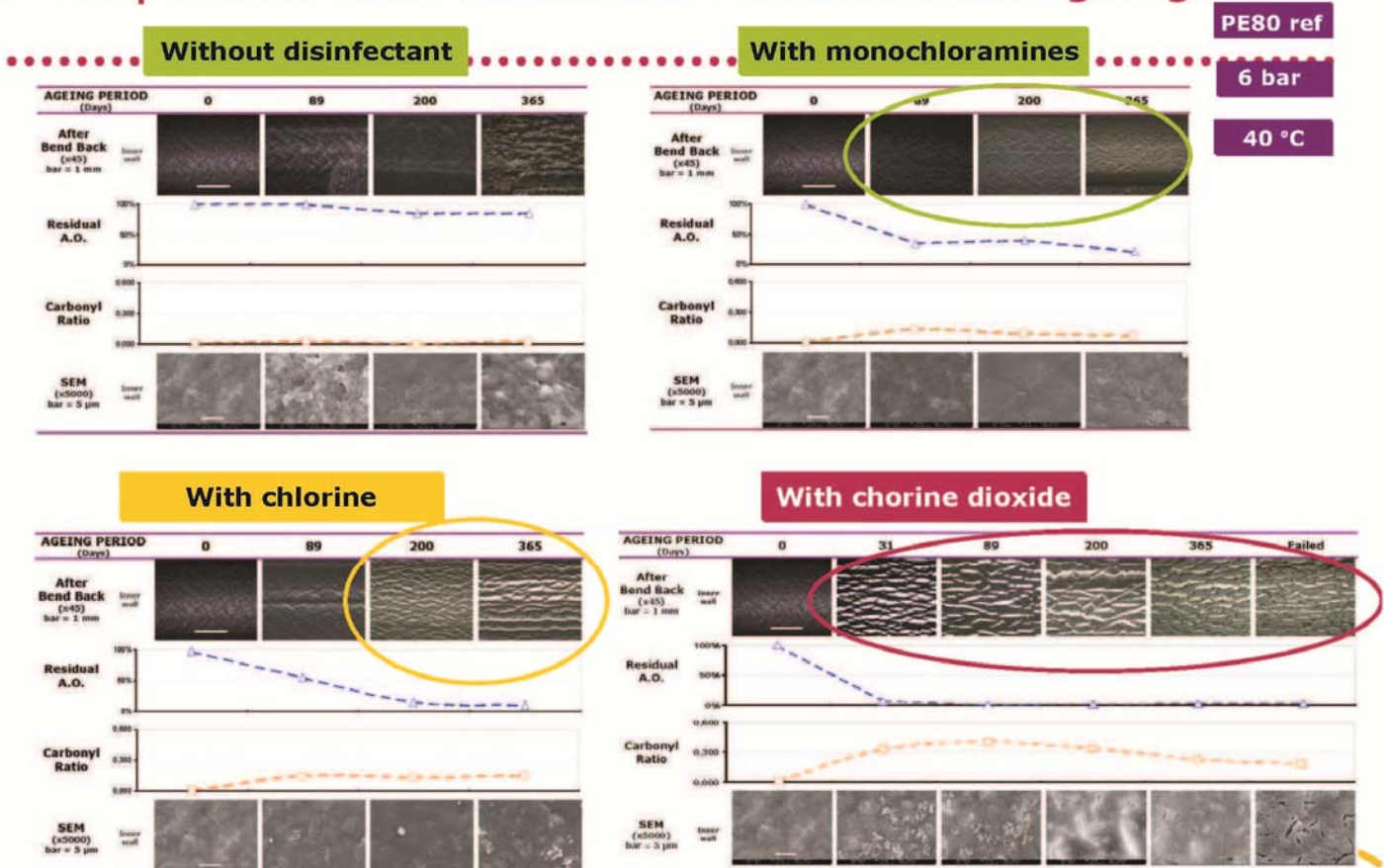
Our PE-PVDF pipe materials have been analysed to ClO₂ (Chlordioxid) resistance. ClO₂ is one of the most aggressive acid fluids for HDPE, almost 7 times more aggressive than other acids like NaOCl (Sodium Hypochloride solution) and NH₂Cl (Monochloramine) which is even less aggressive than NaOCl.

TESTS ON HDPE ONLY

DSC - Differential Scanning for HDPE only

Under accelerated impact tests of different disinfectants on HDPE with pressure of 6 bars at 40°C, the HDPE material only showed very little change and no oxidation even after 365 days, whereas with monochloramines it is reduced to 200 days, with chlorine to 100 days and ClO₂ – chlorine dioxide much less than 31 days, so HDPE itself is not ClO₂ resistant.

➤ **Impact of disinfectants : accelerated ageing**

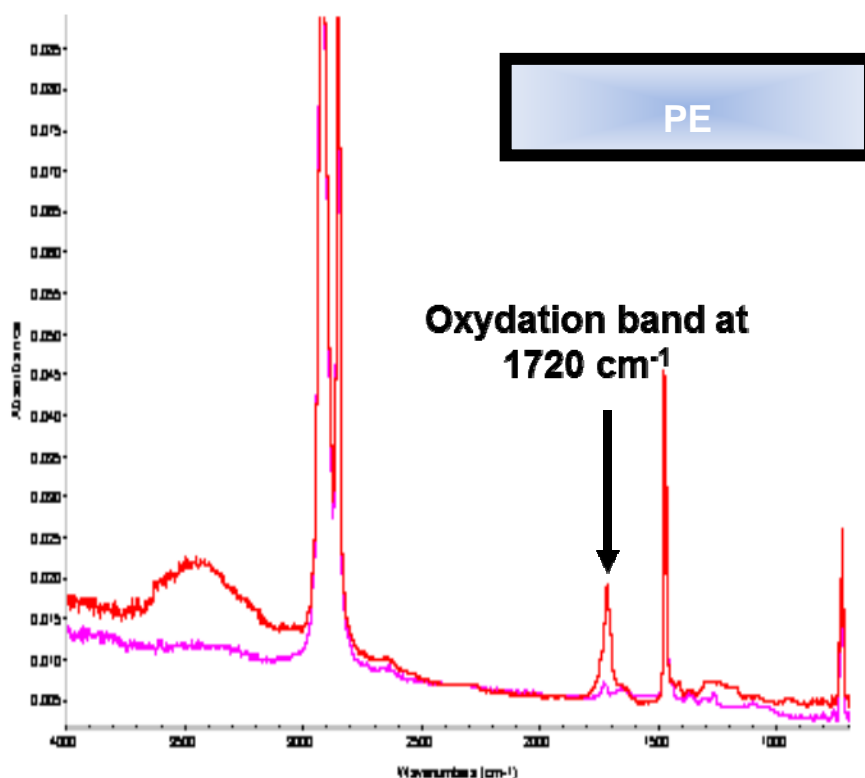


FTIR spectroscopy for HDPE only

The FTIR test has been performed after 4000 hrs chemical resistance ageing test with 70ppm (0,07%) CIO2 at 40°C under pressure of 4 bar.

The test result observed oxidation at the typical HDPE 1712-1720 cm⁻¹ acid oxidation band.

The conclusion is verification of non CIO2 resistance according previous DSC test.



TESTS ON PE PROTECTED BY PVDF

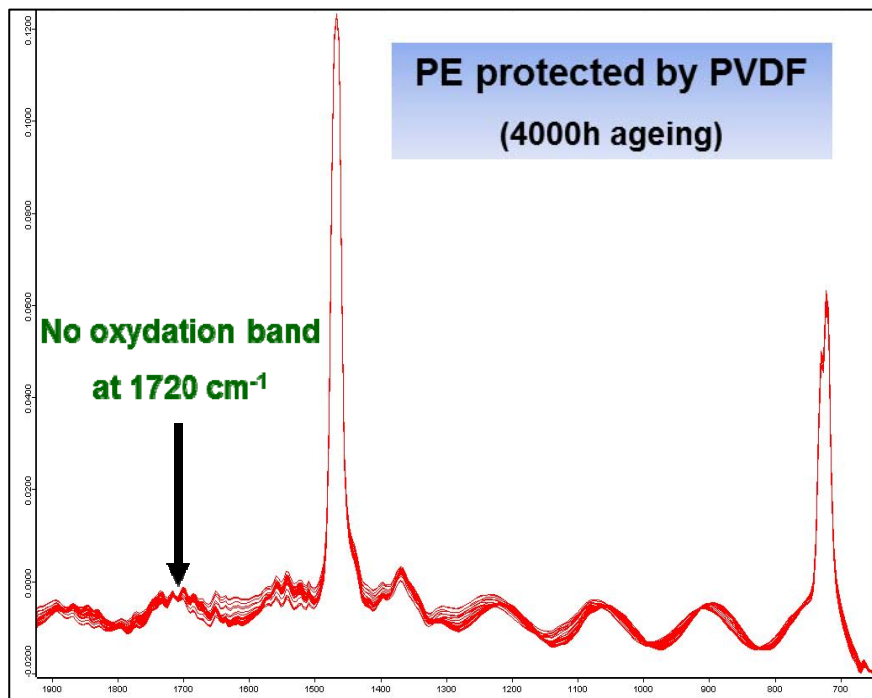
CIO2 Permeation-Test for PVDF

In medium conditions (0,5pp CIO2, 23°C) the permeation result was extremely low by just 0,01 mg/mm/m²/24hrs, so can be named as barrier effect.

FTIR spectroscopy for HDPE protected by 0,5 mm PVDF liner

The FTIR test has been performed after 4000 hrs chemical resistance ageing test with 70ppm (0,07%) ClO₂ at 40°C under pressure of 4 bar.

No oxidation has been observed at the typical HDPE 1712-1720 cm⁻¹ acid oxidation band.



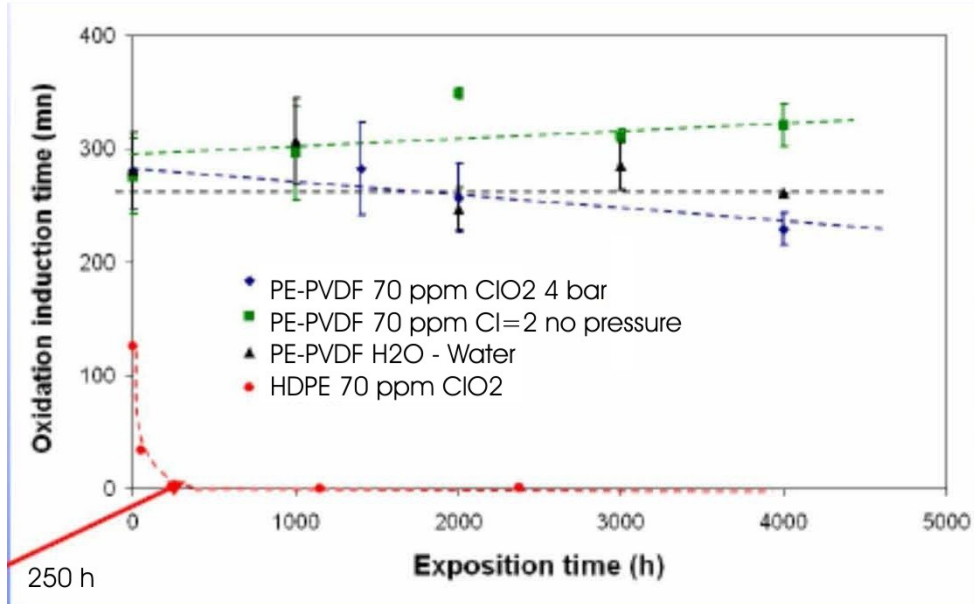
MECHANICAL TESTS ON PE-PVDF PIPES

Hydrostatic Pressure Test of PE-PVDF pipe

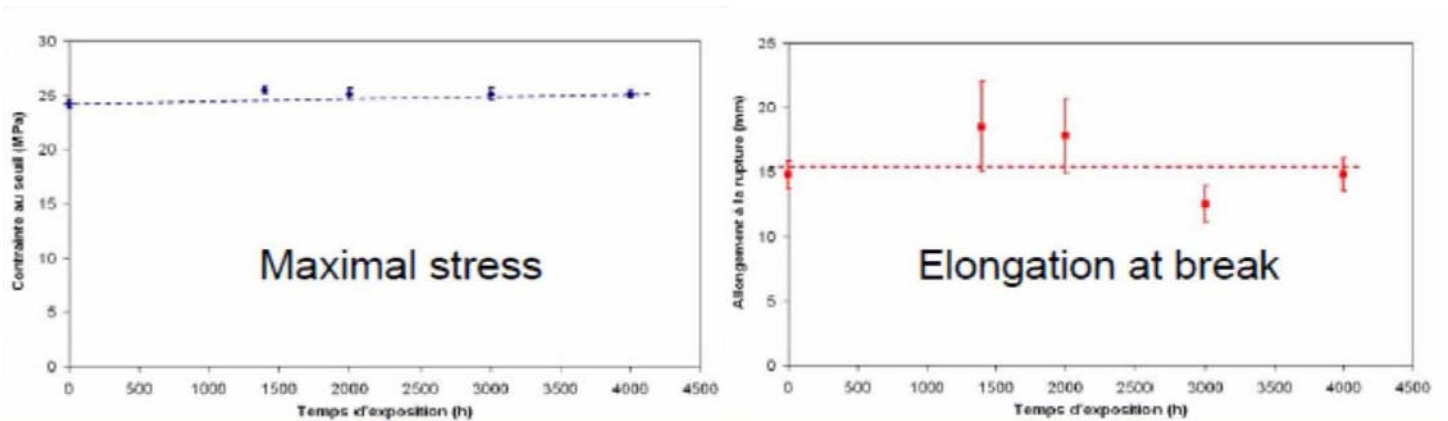
Compliance to Technical Specifications & Standards

Standards	Test	Conclusion	Observation
EN 12201-2 : 2003	TIO > 20 mn at 200°C	✓	In accelerated conditions : 70 ppm ClO ₂ , 40°C, 4 bars
	Hydrostatic pressure resistance 1000h/5MPa/80°C	✓	

OIT (Oxidation Induction Test) of HDPE versus PE-PVDF 0,2 mm layer



Mechanical Tensile Strength Tests (ASTM D 2209-04) of PE-PVDF pipe after 4000 hrs 70 ppm ClO2 @ 4 bar



No reduction of mechanical properties can be observed.

CONCLUSION

Sole HDPE pipes are not chemical resistant at any pressure or temperature for the transport of ClO₂ (Chlordioxide), NaOCl (Sodium Hypochloride) or NH₂Cl (Monochloramine), whereas PE-PVDF pipes for the same chemical solutions have proven resistance even at pressure of 4 bar and temperatures up to 40°C in the verified results of several tests for permeation, spectroscopy, hydrostatic pressure, OIT and tensile strength.

The PVDF liner layer protects the basic HDPE pipe PE layer with excellent long-term durability properties of expected minimum 20 years.