

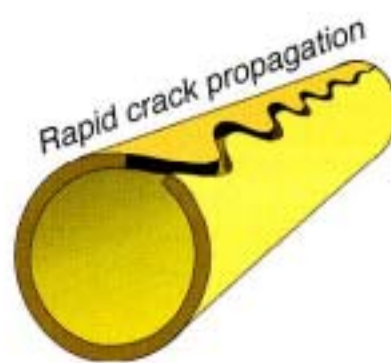
Bodycote Report

RAPID CRACK PROPAGATION - CRITICAL PRESSURE

Rapid crack propagation test (S4) according to ISO 13477 of the black PE pipe grade P502BL from Korea Petrochemical Ind. Co., Ltd.

Final report

Mattias Svedberg



Bodycote Polymer (formerly Studsvik Polymer)

Restricted distribution

BODYCOTE POLYMER AB
(formerly Studsvik Polymer AB)
S-611 82 Nyköping, Sweden
Telephone +46 155 22 14 56
Facsimile +46 155 26 31 25
E-mail svedberg.m@bodycotepolymer.com

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Handled by
Mattias Svedberg

Korea Petrochemical Ind. Co., Ltd.
Ulsan Plant: R&D CENTER
178, Bukok-dong, Nam-ku
Ulsan, Metropolitan City
Korea P.O.Box #47 Ulsan
KOREA
Contact person: Mr. Hyun Soo, Ha

**RAPID CRACK PROPAGATION
- CRITICAL PRESSURE
Rapid crack propagation test (S4) according to ISO 13477
of the black PE pipe grade P502BL from Korea
Petrochemical Ind Co Ltd**

Abstract

A rapid crack propagation testing program has been performed on behalf of Korea Petrochemical Ind. Co., Ltd (herein KPIC). In total 6 pipe specimens, 110 x 10 mm, of the PE pipe grade were tested according to the Small-Scale Steady-State test (S4 test), ISO 13477:1997. The testing was performed at 0°C and at different internal pressures. The results show that the critical pressure is 2.4 bar at 0°C.

Reviewed by



Joakim Jansson

Approved by



Jarno Hassinen

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1 Investigated pipe material

Brand name:	P502BL (Black PE pipe grade)
Resin manufacturer:	KPIC
Lot number:	-
Pipe manufacturer:	-
Production date:	2002-08-10
Nominal pipe dimension:	110 x 10 mm
Arrival date at Bodycote:	2002-09-03
Bodycote internal code:	2994

2 Experimental procedure

All tests have been performed at the Polymer Laboratory at Bodycote Polymer AB. The pipes were cut into lengths of 790 mm. The pipes were conditioned for at least 16 h at 0°C in air. The internal and external medium was air during the test. The testing followed ISO 13477:1997.

3 Results

A total of 6 pipes have been tested. The results are presented in Appendix A and shown in Appendix B.

In order to have crack propagation the crack length shall be at least 4.7 times the nominal diameter (in this case 517 mm). The highest pressure where crack arrest was obtained was at 2.4 bar. Therefore the black PE pipe grade P502BL tested has a critical pressure at 0°C, P_c , of 2.4 bar.

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Table A.1

S4-testing at 0°C of the black PE pipe grade P502BL from KPIC using air as the internal and external test medium. Bodycote internal code is 2994-.

Test laboratory:	Bodycote Polymer AB
Test method:	ISO 13477:1997
Test medium (internal/external):	Air/air
Conditioning method and time:	Air refrigerator, 16 hours
Nominal pipe diameter (D_n) and SDR:	110 mm, SDR 11
Pipe length (total/free):	790/730 mm
Gauge length:	596 mm
Knife speed:	12-15 m/s
Responsible person for the tests:	Fredrik Hegefors

Specimen ¹⁾ (internal code)	Temp °C	Start	t^2 mm	D^3 mm	p^4 bar	Crack length mm	a/D_n^6	Crack propagation ^{7)/} arrest ⁸⁾
2994-1	0	021009	-	110.20	4.0	722	6.56	propagation
2994-2	0	021009	-	110.20	2.6	686	6.24	propagation
2994-3	0	021009	-	110.20	2.5	684	6.22	propagation
2994-4	0	021009	-	110.20	2.4	144	1.31	arrest
2994-5	0	021009	-	110.20	2.2	220	2.00	arrest
2994-6	0	021009	-	110.20	1.9	173	1.57	arrest

1) Internal reference code at Bodycote

2) Minimum wall thickness (not measured)

3) Mean outside diameter

4) Internal over pressure

5) Circumferential stress (hoop stress)

6) a is the crack length and D_n the nominal outside diameter

7) Crack propagation is defined as having taken place when $a \leq 4.7 * D_n$.

8) Crack arrest is defined as having taken place when $a > 4.7 * D_n$.

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Rapid crack propagation diagram

