GlueX-doc-????
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Studies of the oxygen contamination in the Forward Drift Chamber

Abstract

Oxygen contamination at a percent level was found in the production chambers. We present the results of the dedicated studies aimed to identify the main sources of the contamination and implement procudures reducing the oxygen down to acceptable levels.

Table 1: Oxygen contamination as measured with the testing chamber in different configuration. Lexan sheet was always placed at the bottom (and sometimes also on the top) to which the other elements were tightened using steel screws with tourque listed in the table. EPDM, Buna-N, and Viton are different types O-rings installed in grooves in the Spacer ring (two O-rings), or in an empty Cathode Frame type-1 (Frame-1, or Frm-1(coated) when the groove was coated), or in an End Window (End-Win). Cathode type-3 (Cath-3) doesn't have O-ring.

No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
1	air	141,000	220	-	03/29	To callibrate the oxygen sensor
2	gas supply	48	220	-	03/28	directly plugged into sensor; 200 ppm_V measured with a T-connector at the chamber gas inlet with 1600 ppm_V inside
3	Lexan EPDM Spacer EPDM Lexan	400	220	50	03/15	This configuration was used to test the outgassing of different materials inside. Results varied from 400 to 700 ppm_V. Spacer ring used was old one used before for testing

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No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
4	Lexan EPDM Spacer EPDM Cath-3 EPDM End-Win	1600	220	50	03/16-03/19	Using spare End Window, NO coating of the G10 groove
5	Lexan EPDM Spacer EPDM Cath-3 EPDM End-Win	1400	220	100	03/19	Without opening the chamber, just incraesing the torque on the steel screws
6	Lexan Buna-N Spacer Buna-N Cath-3 Buna-N End-Win	940	220	100	03/19-03/22	Replacing the O-rings in the spacer ring and End Window
7	Lexan Buna-N Spacer Buna-N Frame-1 EPDM Lexan	1400	220	100	03/22	To speed up the measurements the top three elements, Cathode type-3 and End Window with O-ring, were replaced with empty Cathode type-1 frame with O-ring and Lexan
8	Lexan Buna-N Spacer Buna-N Frm1(coated) EPDM Lexan	280	220	100	03/23	The only change from No.7 was coating (on another Cathode type-1 frame) the G10 groove and installing same O-ring type

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No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
9	Lexan EPDM Spacer EPDM Frm1(coated) EPDM Lexan	540-580	220	100	03/26	Frame type-1 was repaced with one used in No.7, but coated and EPDM O-ring installed. After 8 hours oxygen dropped to 540 but on the next morning increased to 580 ppm_V
10	Lexan Buna-N Spacer Buna-N Frm1(coated) EPDM Lexan	275	220	100	03/27	Just repeat of No.8
11	Lexan Viton Spacer Viton Frm1(coated) Viton Lexan	287	220	100	03/27	All O-rings replaced with Viton on new Spacer ring and coated G10 frame
12	End(coated) Viton Cathode-3 Viton WireFrm Viton Spacer Viton Cathode-3 Viton End(coated)	500-600	330	100	04/6-04/10	Starting tests at Blue Crab. Full production cell. Some variations of the oxygen depending on the pressure. Huge leakage fixed with C-clamps.
13	air	171,000	220	-	04/10	To callibrate the oxygen sensor
14	gas supply	$\leq$50	220	-	04/10	Like in configuration 2 gas supply directly plugged into sensor.

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No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
15	End(coated) Viton Cathode-3 Viton WireFrm Viton Spacer Viton Cathode-3 Viton End(coated)	900-1000	220	100	04/10-04/11	Just lower flow without changing configuration 12. Some variations of the oxygen depending on the pressure.
16	Lexan EPDM Spacer EPDM Lexan	210	220	100	04/10	Same as conf. 3
17	End(coated) Viton Cathode-3 Viton WireFrm Viton Spacer Viton Cth1(coated) Viton Lexan	1070	220	100	04/11-04/13	From configuration 15, top End Window and Cathode-type-3 replaced with Cathode-type-1 (coated) and Lexan plate. Invetigation possible frame deformation.
18	Lexan EPDM Spacer EPDM Cth1(coated) EPDM Lexan	405	220	100	04/11-04/13	From configuration 16 Cathode-type-1 (coated) with EPDM O-ring inserted in between the top Lexan spacer ring.

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No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
19	Lexan EPDM(Ap.) Spacer EPDM(Ap.) Cth1(coated) EPDM Lexan	51	220	100	04/13-04/16	Same as 18 but applied Apiezon(L) on the two O-rings of the spacer. After opening found Apiezon has reacted with EPDM resulting in swelling and loosing elaticity, but at the same time well sealed to the surfaces.
20	Lexan Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) EPDM Lexan	70	220	100	04/16-04/18	Same as 19 but Viton instead of EPDM (also with Apiezon(L)) on the two O-rings of the spacer.
21	Lexan Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) EPDM Lexan	116-125	110	100	04/19	Lower the gas flow both through the chamber and through the oxygen sensor
22	End(coated) Viton(Ap.) Cathode-3 Viton(Ap.) WireFrm Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) Viton(Ap.) Lexan	75	220	100	04/18-04/19	First full production cell with Apiezon

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No	Conig.	Oxygen (ppm_V)	Flow (sc-cpm)	Torque (in oz)	Date	Comment
23	End(coated) Viton(Ap.) Cathode-3 Viton(Ap.) WireFrm Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) Viton(Ap.) Lexan	119	110	100	04/18-04/19	Lower flow
24	End(coated) Viton(Ap.) Cathode-3 Viton(Ap.) WireFrm Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) Viton(Ap.) Lexan	195	55	100	04/18-04/19	Lower flow
25	Four times: End(coated) Viton(Ap.) Cathode-3 Viton(Ap.) WireFrm Viton(Ap.) Spacer Viton(Ap.) Cth1(coated) Viton(Ap.) Lexan	111	220	100	04/26-05/04	Four production cells with Apiezon