Letter of Attestation

Document: 80008629 **Master Contract:** N/A

Project: 80040846 **Date Issued:** July 22, 2020

Issued to: **Contemporary Amperex Technology Co., Limited**
No. 2 Xingang Road, Zhangwan Town, Jiaocheng District
Ningde City, Fujian Province 352100, P. R. China
Attention: [redacted]

CSA Group hereby confirms that it has completed an evaluation of:
Li-ion Battery Cell, models 001CB310, CB310 and CB2W0

CSA Group hereby attests that the products identified above and described in test report 80008629 dated Jan 29, 2019 complies with the following test, to the extent applicable:

UL 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, 3rd edition, Revision Date Jun 15, 2018 Section 6 Cell Level testing.

Issued by: [redacted]

CSA Group

THIS LETTER OF ATTESTATION DOES NOT AUTHORIZE THE USE OF THE CSA MARK ON THE SUBJECT PRODUCTS.
QUOTATIONS FROM THE TEST REPORT OR THE USE OF THE NAME OF THE CANADIAN STANDARDS ASSOCIATION AND CSA GROUP OR ITS REGISTERED TRADEMARK, IN ANY WAY, IS NOT PERMITTED WITHOUT PRIOR WRITTEN CONSENT OF CSA GROUP.

Descriptive Report and Test Results

MASTER CONTRACT: N/A
REPORT: 80008629
PROJECT: 80040846

Edition 1: Jan 29, 2020; Project 80008629 [redacted]

Edition 2: July 22, 2020; Project 80040846 [redacted]

Contents: Letter of Attestation - Page 1 to 1
Description and Tests - Pages 1 to 28

PRODUCTS

Li-ion Battery Cell, models 001CB310, CB310 and CB2W0, nominal voltage 3.2V, 280Ah

APPLICABLE REQUIREMENTS

UL 9540A - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, 3rd edition

The results relate only to the items tested. This report shall not be reproduced, except in full, without the approval of CSA Group.

DESCRIPTION AND TEST REPORTS

Testing Laboratory Name:	CCIC-CSA International Certification Co., Ltd. Kunshan Branch
Address:	Building 8, Tsinghua Science Park, No. 1666 Zu chongzhi Rd (S) , Kunshan, Jiangsu (215347)
Testing Program:	**Custom Test:** Latter of Attestation [X] Testing Only [ ] Note: Mark " X " in applicable test program block

If tests were performed at another facility, then described below:

Testing Laboratory Name:	Contemporary Amperex Technology Co., Limited
Address:	No. 2 Xingang Road, Zhangwan Town, Jiaocheng District Ningde City, Fujian Province 352100, P. R. China
Facility Qualification Number:	N/A

	As above / or describe otherwise
Customer:	Contemporary Amperex Technology Co., Limited
Address:	No. 2 Xingang Road, Zhangwan Town, Jiaocheng District Ningde City, Fujian Province 352100, P. R. China

Tested By: [redacted] Test Engineer
Name, Title

[redacted] Test Engineer 2019-06-19
Signature *Date (YYYY-MM-DD)*

☐ **Reviewed by:** [redacted] Certifier
☒ **Witnessed by:** *Name, Title*

[redacted] 2020-01-19
Signature *Date (YYYY-MM-DD)*

Version: 2019-05-09

Product Details	
Test Request:	☒ Cell Level Testing ☐ Module Level Testing ☐ Unit Level Testing ☐ Installation Level Testing
Manufacturer	☒ Cell: Contemporary Amperex Technology Co., Limited ☐ Module: ☐ Unit:
Brand name / Trademark	☒ Cell: N/A ☐ Module: ☐ Unit:
Model Number	☒ Cell: 001CB310, CB2W0, CB310 ☐ Module: ☐ Unit:
Date of receipt of test sample(s)	2019-06-07
Cell/Battery Type	Li-ion, LFP
Approximate Dimension (mm)	☒ Cell: 174.0*207.2*71.7mm ☐ Module: ☐ Unit:
Mass (g)	☒ Cell: see page 5 ☐ Module: ☐ Unit:
DUT Sample/Serial Number	☒ Cell: See page 5 ☐ Module: ☐ Unit:
DUT Nominal Voltage Rating (V)	☒ Cell: 3.2V ☐ Module: ☐ Unit:
DUT Nominal Charge Capacity Rating (Ah)	☒ Cell: 280Ah ☐ Module: ☐ Unit:
Fire Mitigation Strategies: (For installation level testing)	☐ Water: ☐ Other (Specify): ☒ N/A
Additional Information	N/A

Model Difference: Cell model CB2W0 is identical to model 001CB310 except for the rated charging/discharging current declared, documented in UL with project No. 4789439215, herein, test on model 001CB310 was considered to representative of model CB2W0. JZ 2020-04-16

Models CB2W0 and CB310 are identical to model 001CB310 except for model names, and the declared ratings of pulse charging and discharging current.

THE TESTING SPECIFIED IN THIS PROCEDURE IS INHERENTLY DANGEROUS

DO NOT ATTEMPT TO PERFORM THIS TEST UNLESS YOU HAVE BEEN PROPERLY TRAINED REGARDING SAFELY WORKING WITH THE HAZARDS INVOLVED

Important Test Consideration:

- As some batteries expose in test described above, it is important that personal be protected from the flying fragments, explosive force, and sudden release of heat, chemical burns, and noise result from such explosions. The test area is to be well ventilated to protect personal from possible harmful fumes or gases.
- Temperature of the surface of the battery casing shall be monitored during the tests described above. All personal involve in the testing of batteries are to be instructed never to approach a battery until the surface temperature return to ambient temperature.
- Test shall be conducted in separate room or equipped with an adequate safety barrier separating the test area from observer.

UL 9540 A – Definition

- "BATTERY ENERGY STORAGE SYSTEM (BESS)" - Stationary equipment that receives electrical energy and then utilizes batteries to store that energy for later use in order to supply electrical energy when needed. The BESS consists of one or more modules, a power conditioning system (PCS) and balance of plant components.

a) INITIATING BATTERY ENERGY STORAGE SYSTEM UNIT (INITIATING BESS) – A BESS unit which has been equipped with resistance heaters in order to create the internal fire condition necessary for the installation level test (Section 8).
b) TARGET BATTERY ENERGY STORAGE SYSTEM UNIT (TARGET BESS) – The enclosure and/or rack hardware that physically supports and/or contains the components that comprise a BESS. The target BESS unit does not contain energy storage components, but serves to enable instrumentation to measure the thermal exposure from the initiating BESS.

- "CELL" -The basic functional electrochemical unit containing an assembly of electrodes, electrolyte, separators, container, and terminals. It is a source of electrical energy by direct conversion of chemical energy.

- "DUT" – Device under test.

- "ELECTRICAL RESISTANCE HEATERS" – Devices that convert electrical energy supplied from a laboratory source into thermal energy.

- "FLEXIBLE FILM HEATERS" – Electrical resistance heaters of a film, tape or otherwise thin sheet like construction that easily conform to the surface of cells.

- "MODULE" – A subassembly that is a component of a BESS that consists of a group of cells or electrochemical capacitors connected together either in a series and/or parallel configuration (sometimes referred to as a block) with or without protective devices and monitoring circuitry.

- "STATE OF CHARGE (SOC)" – The available capacity in a BESS, pack, module or cell expressed as a percentage of rated capacity.

- "THERMAL RUNAWAY" – The incident when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate. This may lead to fire, explosion and gas evolution.

- "UNIT" – A frame, rack or enclosure that consists of a functional BESS which includes components and subassemblies such a cells, modules, battery management systems, ventilation devices and other ancillary equipment.

UL 9540A Third Edition, Dated June 15, 2018 - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

<table>
<tr><th>Section</th><th>Requirement</th><th>Test (T) / Waive (W) / Not App. (N/A)</th><th>Comments</th></tr>
<tr><td rowspan="4">1</td><td colspan="3">Scope:
The test methodology in this document evaluates the fire characteristics of a battery energy storage system that undergoes thermal runaway.

Fire protection requirements not related to battery energy storage system equipment are covered by appropriate installation codes.</td></tr>
<tr><td>Section 6: Cell Level Test</td><td>T</td><td>Chemistry: Li-ion
Physical Format: Prismatic
Energy (Whr): 896
Capacity (Ahr): 280
Nominal Voltage (Vdc): 3.2
Approximate Dimension (mm): 174.0*207.2*71.7mm
Weight (g): See below:
<table><tr><th rowspan="2">Sample ID</th><th colspan="2">Weight, g</th></tr><tr><th>Before Test</th><th>After Test</th></tr><tr><td>0818CAS01064</td><td>5412.4</td><td>4153.6</td></tr><tr><td>0818CAS01045</td><td>5399.6</td><td>4146.1</td></tr><tr><td>0818CAS01180</td><td>5391.1</td><td>4149.0</td></tr><tr><td>0818CAS01047</td><td>5414.1</td><td>4153.2</td></tr></table>Cell Comply With UL 1973 Requirement (Yes/No) : Yes
Cell with UL approval under File MH62898, Vol.1, Project number 4789054368.</td></tr>
<tr><td>Section 7: Module Level Test</td><td>N/A</td><td>Module Level testing not requested by manufacturer</td></tr>
<tr><td></td><td>Section 8: Unit Level Test</td><td>N/A</td><td>Unit Level testing not requested by manufacturer</td></tr>
<tr><td></td><td>Section 9: Installation Level Test
(With fire mitigation strategies)</td><td>N/A</td><td>Installation Level testing not requested by manufacturer</td></tr>
</table>

UL 9540A Third Edition, Dated June 15, 2018 - Section 6 Cell Level Testing

Section	Requirement	Comments	Verdict
Possible test case verdicts: Test case does not apply to the test object: N/A (Not Applicable) Test object does meet the requirement: P (Pass) Test object does not meet the requirement: F (Fail)			
6	Cell Level Testing		P
6.1	Cell Sample conditioned for min 2 charge (100% SOC) - discharge (Specified end of discharge voltage) cycle as per manufacturer specified method.	Manufacture recommended charge/discharge method: Charging Procedure: CC-CV Charging Voltage (V): 3.65 Charging Current (A): 140 Charging End Condition (A): 14 Discharging Procedure: CC Discharging Current (A): 140 End of Discharge Voltage (V): 2.5	P
	Cells under test are functional after charge discharge cycle.	☒ Conformed	P
	Ambient temperature during cell conditioning and during test……..……: Note: Ambient indoor laboratory conditions shall be 25 ±5°C (77 ±9°F) and 50 ±25% RH at the initiation of the test.	Temperature(ºC): 24.5 to 24.5 Humidity (% RH): 60 to 70	P
	The tested cells have 100% SOC at the start of the test. The samples were allowed to stabilize for a minimum of one hour prior to testing.	☒ Conformed	P
6.2	Propensity of cell to exhibit thermal runaway demonstrated by externally applied Film Heater	☒ Additional method used: External heating method with ceramic heater 1 PCS, rated 220/230V, 500W.	N/A
	Surface heating rate maintained at 5°C (9°F) to 7°C (12.6°F) per minute	The heating rate is greater than 7°C per minute, thermal runaway was triggered, with total 4 cell samples tested.	N/A
	Other alternate method used to exhibit thermal runaway	Thermal runaway was triggered on total 4 cells using external heating methods in a 82L vessel one by one, with initial gases inside the vessel measured, released gases after thermal runaway were collected, temperature	P

Section	Requirement	Comments	Verdict
Possible test case verdicts: Test case does not apply to the test object: N/A (Not Applicable) Test object does meet the requirement: P (Pass) Test object does not meet the requirement: F (Fail)			
		in which the cell first vented and thermal runaway triggered monitored and also gas composition measured.	
	Temperature measurement recorded using thermocouple junction formed from 30-gauge Type-K thermocouple wire. 	☒ Conformed See below for the thermocouple locations: CH-3: Vessel upper inside CH-4: Vessel inside(above the cell venting hole) CH-5: Cell container (near the venting hole) CH-6: Cell container(side) CH-7: Vessel bottom inside CH-8: Heater surface	P

Section 6.2 **TABLE: Determination of thermal runaway methodology**

Sample No	Open Circuit Voltage Before Test (Vdc)	Cell Failure method	Cell Surface Temperature at which gases are first vented (°C)	Cell Surface Temperature prior to thermal runaway (°C)	Location Maximum Temperature prior to ther runaway
0818CAS01064	3.38	External Heating	130.3	193.4	Cell Side enclosure
0818CAS01045	3.39	External Heating	147.8	223.4	Cell Side enclosure
0818CAS01180	3.39	External Heating	149.3	211.2	Cell Side enclosure
0818CAS01047	3.36	External Heating	145.9	211.2	Cell Side enclosure

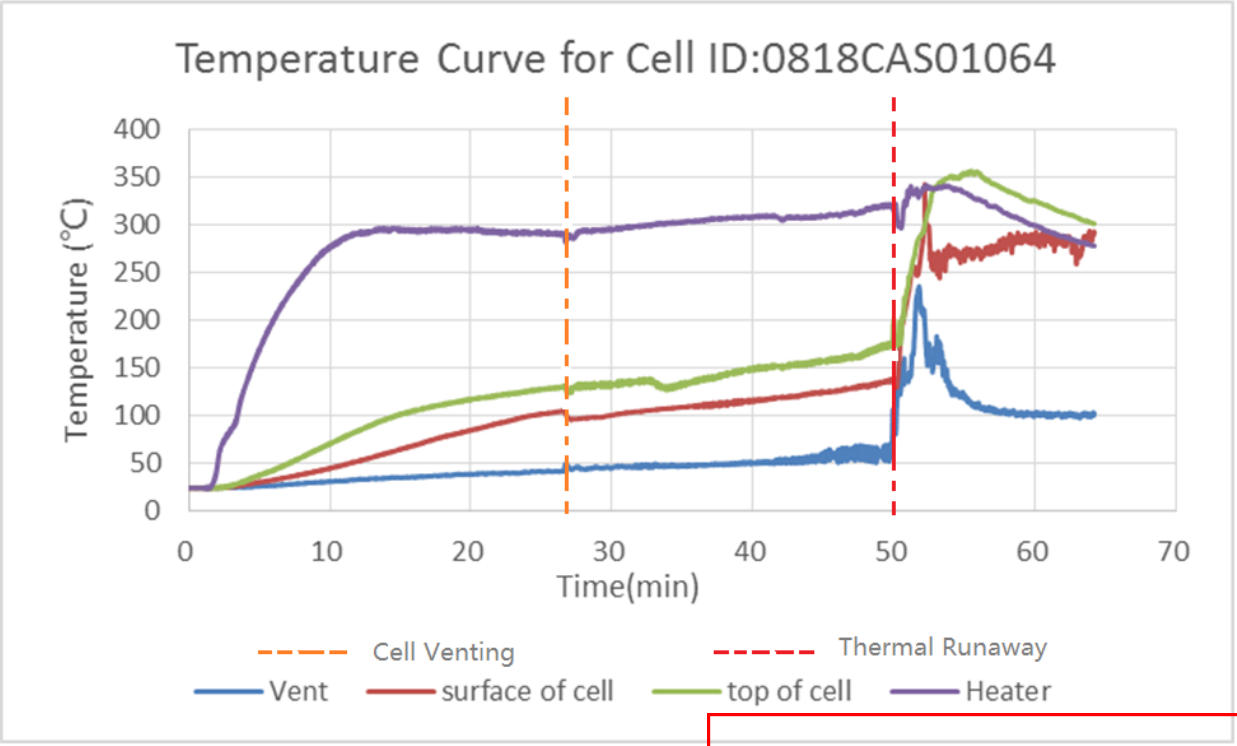
Supplementary information:

Section	Requirement	Comments	Verdict

Possible test case verdicts:

Test case does not apply to the test object: N/A (Not Applicable)
Test object does meet the requirement: P (Pass)
Test object does not meet the requirement: F (Fail)

Temperature Curve and test sample figure:



Sample ID: 0818CAS01064

Before Test

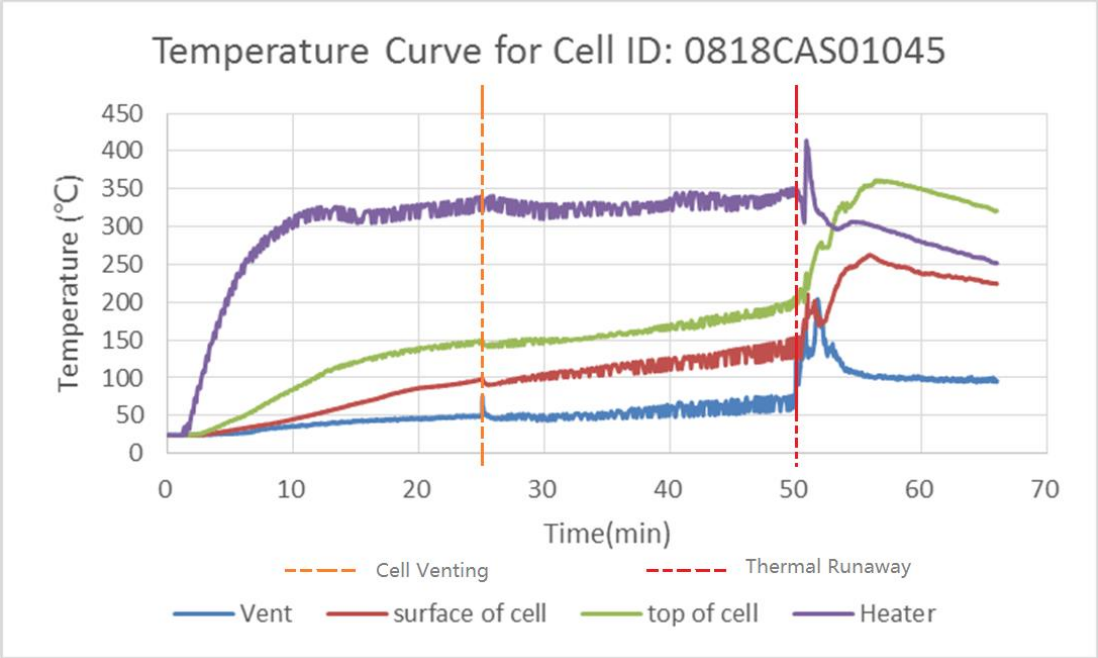
After Test

Temperature Curve and test sample figure:

Section	Requirement	Comments	Verdict

Possible test case verdicts:

Test case does not apply to the test object: N/A (Not Applicable)
Test object does meet the requirement: P (Pass)
Test object does not meet the requirement: F (Fail)



Sample ID : 0818CAS01045

Before Test

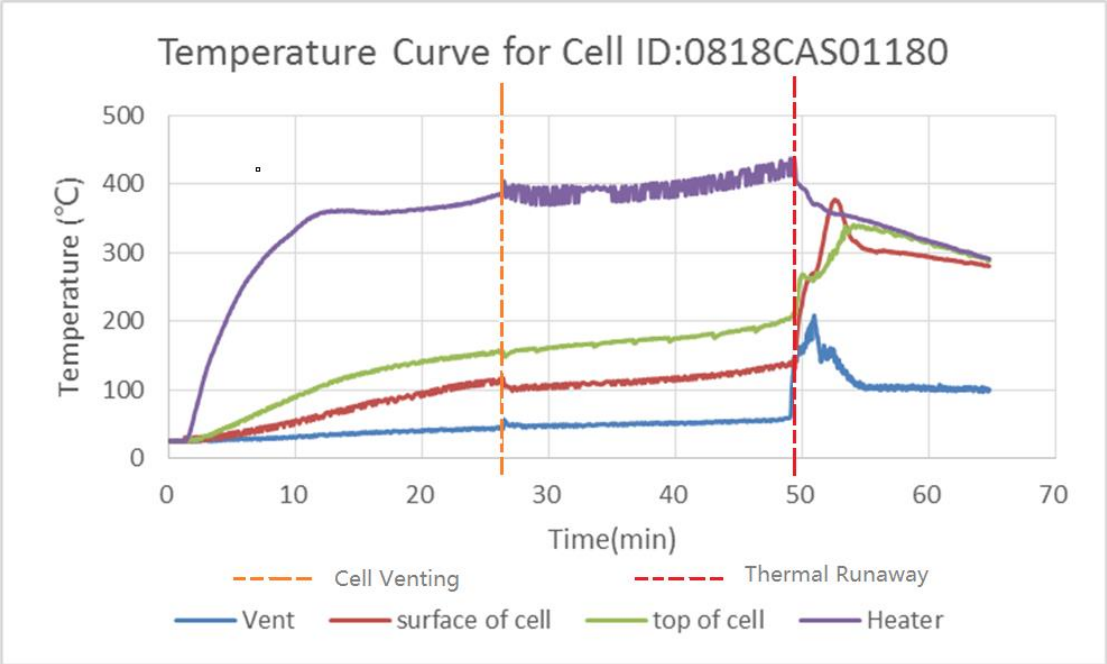
After Test

Temperature Curve and test sample figure:

Section	Requirement	Comments	Verdict

Possible test case verdicts:

Test case does not apply to the test object: N/A (Not Applicable)
Test object does meet the requirement: P (Pass)
Test object does not meet the requirement: F (Fail)



Sample ID : 0818CAS01180

Before Test

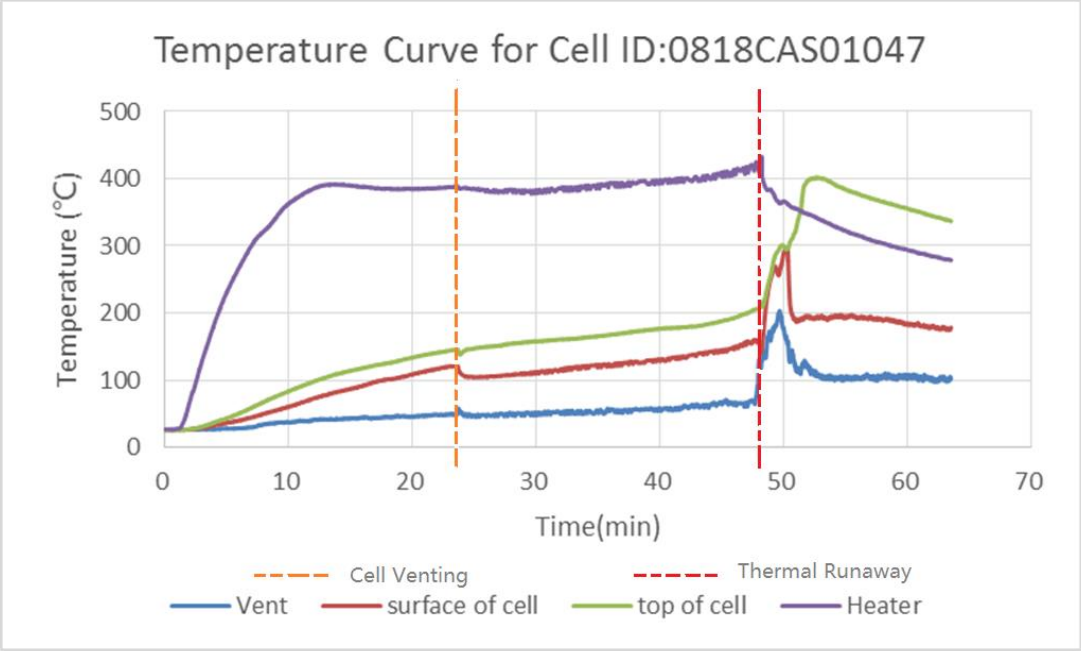
After Test

Temperature Curve and test sample figure:

Section	Requirement	Comments	Verdict

Possible test case verdicts:

Test case does not apply to the test object: N/A (Not Applicable)
Test object does meet the requirement: P (Pass)
Test object does not meet the requirement: F (Fail)



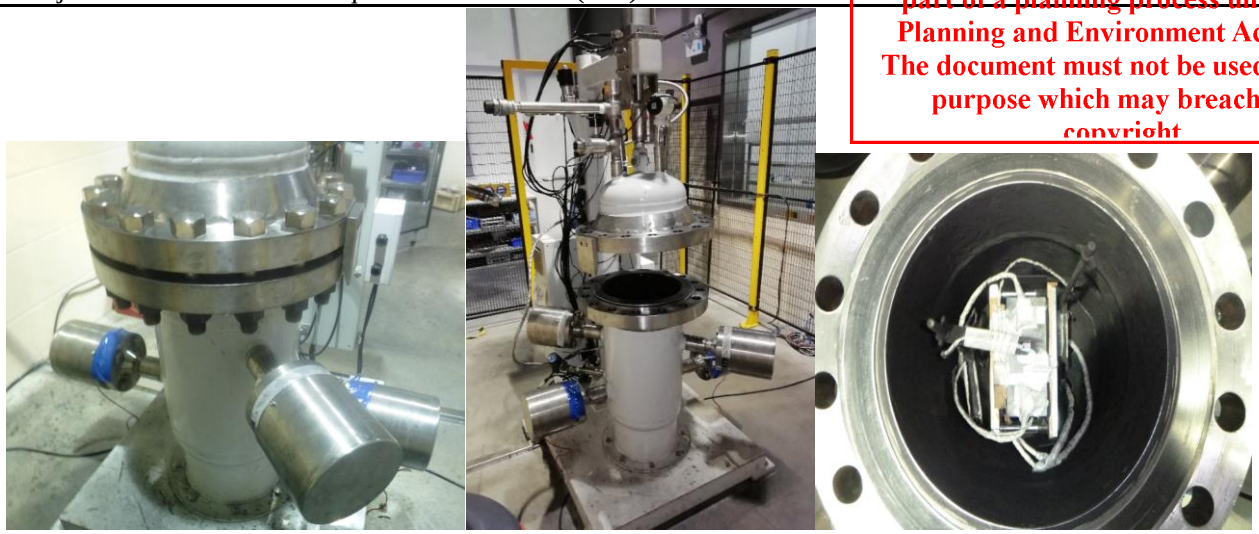
Sample ID : 0818CAS01047

Before Test

After Test

Test Apparatus Picture:

Section	Requirement	Comments	Verdict
Possible test case verdicts: Test case does not apply to the test object: N/A (Not Applicable) Test object does meet the requirement: P (Pass) Test object does not meet the requirement: F (Fail)			



a) b) c)

Figures. a), b) overall view of the reactor; c) inside view of the reactor

Equipment Used: Item no. 1,2,3,4,5,6
Date Start: 19/06/13 (YY/MM/DD)
Date End: 19/06/19 (YY/MM/DD)

6.3	Cell vent gas generated and captured inside an 82-L (21.7-gal) pressure vessel. The test initiated with an initial condition of atmospheric pressure and less than 1% oxygen by volume.	☒ Conformed The test vessel was purified using high purity nitrogen to make sure the oxygen was less than 1% by volume in the initial test condition	P
	Cell vent gas composition determined using following method.	See below	P
	1. Fourier-Transform Infrared Spectrometer with a minimum resolution of 1.0 cm-1 and a path length of at least 6.6 ft. (2 m), or	Other equivalent method used	N/A
	2. Equivalent gas analyser	☒ Conformed GC-MS was used for Gas composition analysis.	P
	Hydrogen gas was measured with a sensor capable of measuring in excess of 30% by volume.	☒ Conformed GC-MS was used for Hydrogen gas measurement	P

Section	Requirement	Comments	Verdict
Possible test case verdicts: Test case does not apply to the test object: N/A (Not Applicable) Test object does meet the requirement: P (Pass) Test object does not meet the requirement: F (Fail)			
	The lower flammability limit of the cell vent gas was determined in accordance with ASTM E681	Gas Volume: 163.8L(STP Condition) Measured LFL:6.14%@12~18 ºC, 101.3~101.5kPa Measured LFL at venting temperature = 5.4%@143± 1° C, 101± 2kPa Gas Burning Velocity: 0.584m/s @ ambient temperature (22~30°C), atmospheric pressure. Pmax:109.36PSI(0.754MPa)	P

Section 6.3	**TABLE: Cell vent gas composition test**			
Sample No	0818CAS01064	0818CAS01045	0818CAS01180	0818CAS01047
Open Circuit Voltage Before Test (Vdc):	3.380	3.389	3.390	3.360
Cell Failure method:	External Heating			
Pressure Vassal Volume (liter):	82	82	82	82
Cell Surface Temperature at which gases are first vented (ºC):	130.3	147.8	149.3	145.9
Cell Surface Temperature prior to thermal runaway (ºC):	193.4	223.4	211.2	211.2
Location of Maximum Temperature prior to thermal runaway:	Cell Side Enclosure			
Atmospheric Pressure Before Test (kPA):	8	3.75	8.75	14
Oxygen volume in pressure Vessel Before Test (%):	0.76	0.80	0.38	0.59
Gas Composition				

Note: Totally 4 cell samples were tested individually in a 82L reactor with an initial temperature condition 24.2 ºC. The 4 cells were forced to thermal runaway using ceramic heater rated 220/230V, 500W. Before each testing, the vessel was purified by high purity nitrogen to make sure the oxygen was less than 1% by volume, Composition and concentration of the gas mixtures were identified and measured using gas chromatography. Gas mixtures were collected before and after thermal runaway testing, total 3 bag of gas samples for each cell sample, 1 indicated the initial atmospheric inside the vessel, 2 indicated the gas mixtures released during thermal runaway.
Gas volume released was measured using the gas components data of the cell sample 0818CAS01045 for calculation.

See below table for the gas quantification:

Gas Sample	1521-04(3)
Gas	**Measured %**
H2	33.30%
CO	6.74%
CO2	19.63%
CH4	3.16%
C2H4	3.28%
C2H6	0.92%
C3H6	1.09%
C3H8	0.27%

O2	0.25%
N2	31.36%

Gas quantification excluding N_2 and O_2

Gas Sample	1521-04(3)
Gas	**Measured %**
H2	48.69%
CO	9.86%
CO2	28.70%
CH4	4.62%
C2H4	4.80%
C2H6	1.35%
C3H6	1.59%
C3H8	0.39%

Approximately 68.39% of the gas mass is accounted for in the testing, most of the remainder of the gas are air components (N_2, O_2), which makes up 31.61% by volume. Total 163.8L(STP Conditions) gas mixtures collected during the testing excluding N_2 and O2.

Average cell surface temperature at gas venting: 143.3 ºC;
Average cell surface temperature at cell thermal runaway: 209.8 ºC.
Gas Volume: 163.8L
Gas Composition: H_2 48.69%, CO 9.86%, CO_2 28.70%, CH_4 4.62%, C_2H_4 4.80%, C_2H_6 1.35%, C_3H_6 1.59%, C_3H_8 0.39%.
Lower Flammability Limit(LFL) = 6.14%@12~18 ºC,101.3~101.5kPa
Lower Flammability Limit（LFL）at venting temperature = 5.4%@143±1°C, 101±2kPa
Gas Burning Velocity: 0.584m/s @ ambient temperature (22~30°C), atmospheric pressure.
Pmax:109.36PSI(0.754MPa)
Pmax Rise Rate: 23153.83(159.64MPa/Sec) PSI/Sec

Supplementary information:

- Sample ID Instruction(Cell VS Gas Sample)

Gas Sample ID	Note	Cell Sample ID
S1-20190619-1521-01	Initial gas sample(before test)	0818CAS01064
S1-20190619-1522-05	Gas sample A after test	0818CAS01064
S1-20190619-1521-03	Gas sample B after test	0818CAS01064
S1-20190619-1522-02	Initial gas sample(before test)	0818CAS01045
S1-20190619-1522-06	Gas sample A after test	0818CAS01045
S1-20190619-1521-06	Gas sample B after test	0818CAS01045
S1-20190619-1522-03	Initial gas sample(before test)	0818CAS01180
S1-20190619-1522-01	Gas sample A after test	0818CAS01180
S1-20190619-1521-04	Gas sample B after test	0818CAS01180
S1-20190619-1522-04	Initial gas sample(before test)	0818CAS01047
S1-20190619-1521-02	Gas sample A after test	0818CAS01047
S1-20190619-1521-05	Gas sample B after test	0818CAS01047

- The composition for the gas released.(%)

气体成分气相色谱分析

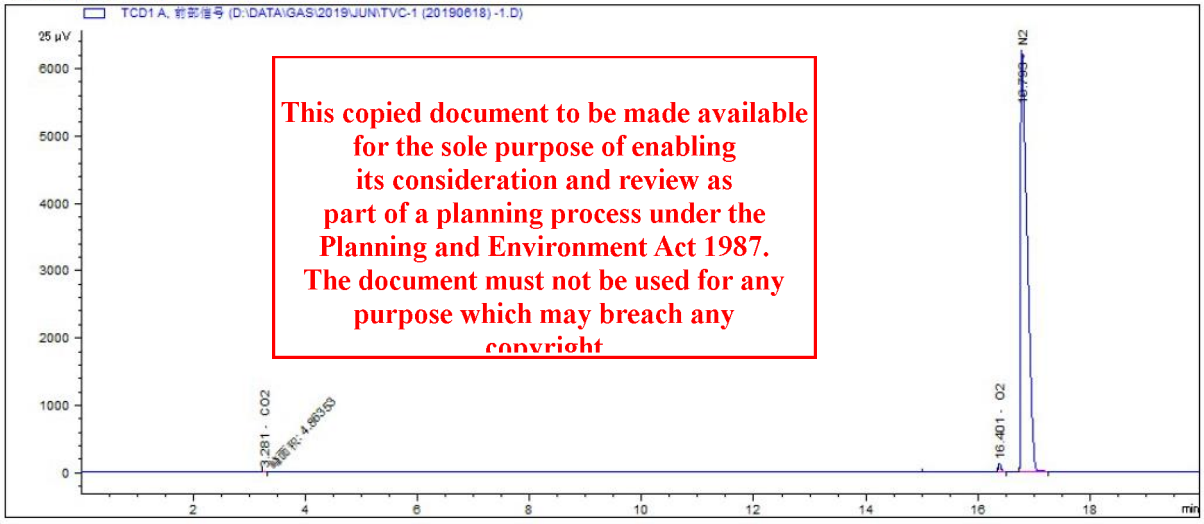
样品编号 Sample No.	气体成分 Gas Components									
	CO2	C2H4	C2H6	C3H6	C3H8	H2	O2	N2	CH4	CO
S1-20190619-1521-01	0.01	/	/	/	/	/	0.76	99.23	/	/
S1-20190619-1521-02	20.09	3.38	0.92	1.07	0.26	30.28	0.44	33.58	3.29	6.68
S1-20190619-1521-03	21.04	3.65	1.00	1.09	0.33	25.66	0.68	35.79	3.53	7.23
S1-20190619-1521-04	19.63	3.28	0.92	1.09	0.27	33.30	0.25	31.36	3.16	6.74
S1-20190619-1521-05	20.15	3.51	0.94	1.12	0.28	30.82	0.37	32.67	3.24	6.90
S1-20190619-1521-06	18.09	3.12	0.82	0.98	0.24	37.40	0.43	30.03	2.94	5.94

气体成分气相色谱分析

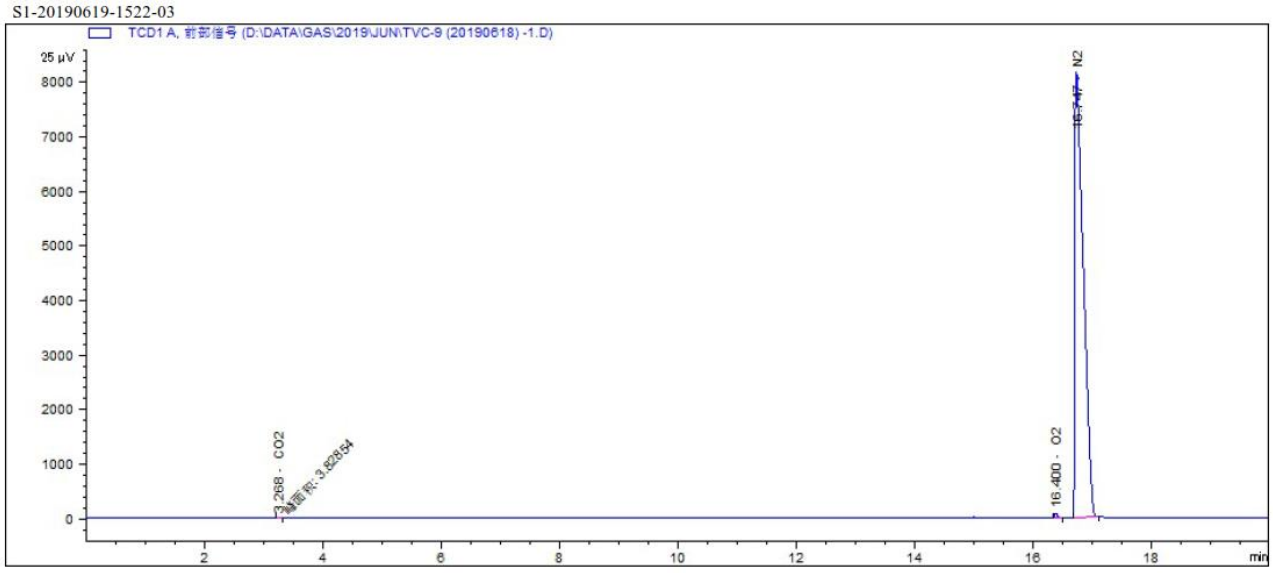
样品编号 Sample No.	气体成分 Gas Components									
	CO2	C2H4	C2H6	C3H6	C3H8	H2	O2	N2	CH4	CO
S1-20190619-1522-01	19.90	3.48	0.95	1.06	0.27	30.15	0.62	33.48	3.31	6.77
S1-20190619-1522-02	0.02	/	/	/	/	/	0.80	99.19	/	/
S1-20190619-1522-03	0.01	/	/	/	/	/	0.38	99.62	/	/
S1-20190619-1522-04	0.01	/	/	/	/	/	0.59	99.40	/	/
S1-20190619-1522-05	19.79	3.23	0.93	1.06	0.28	30.69	0.51	34.30	3.10	6.11
S1-20190619-1522-06	19.43	3.14	0.91	1.04	0.28	32.31	0.53	33.42	3.02	5.93

- GC-MS spectrogram analysis for gas before test : cell sample ID: 0818CAS01064

S1-20190619-1521-01

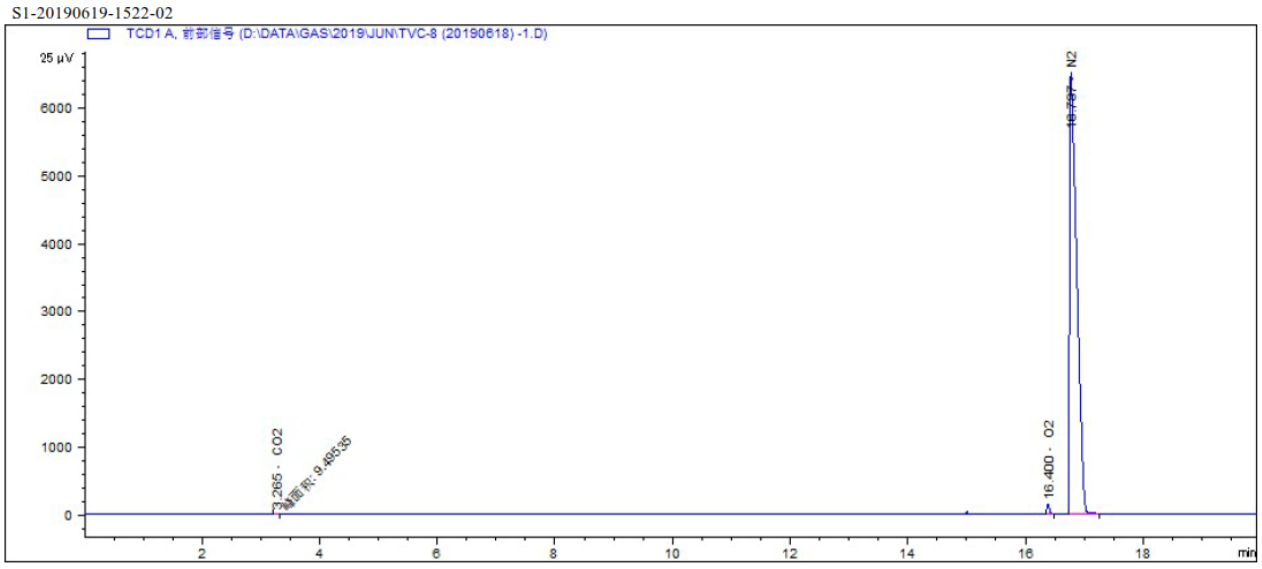


- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01064

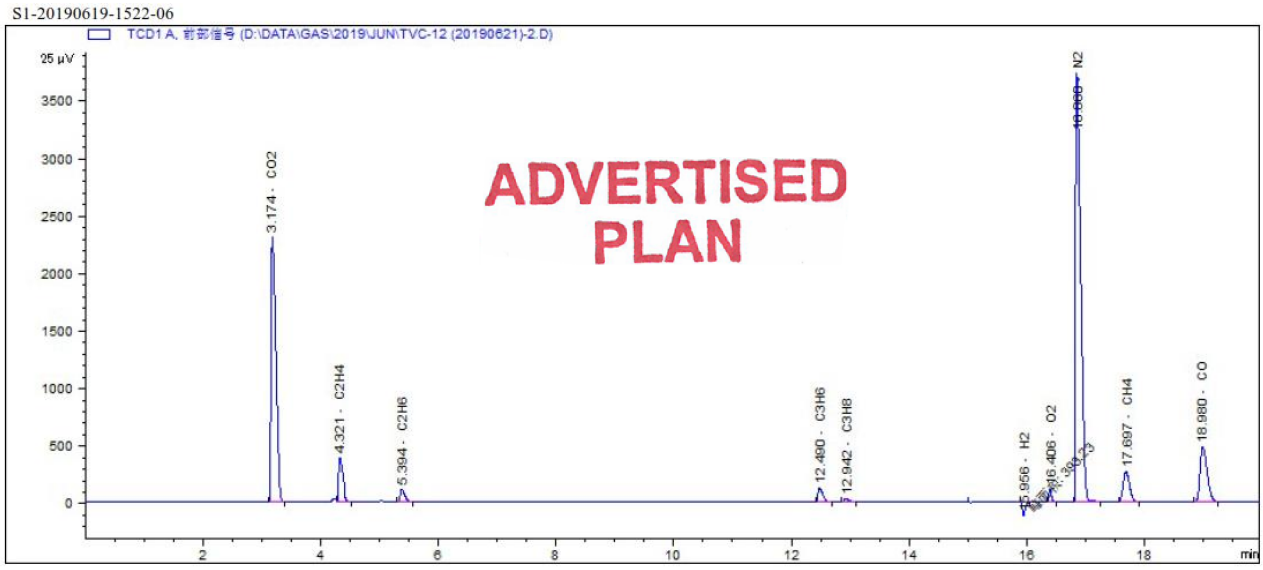


- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01064

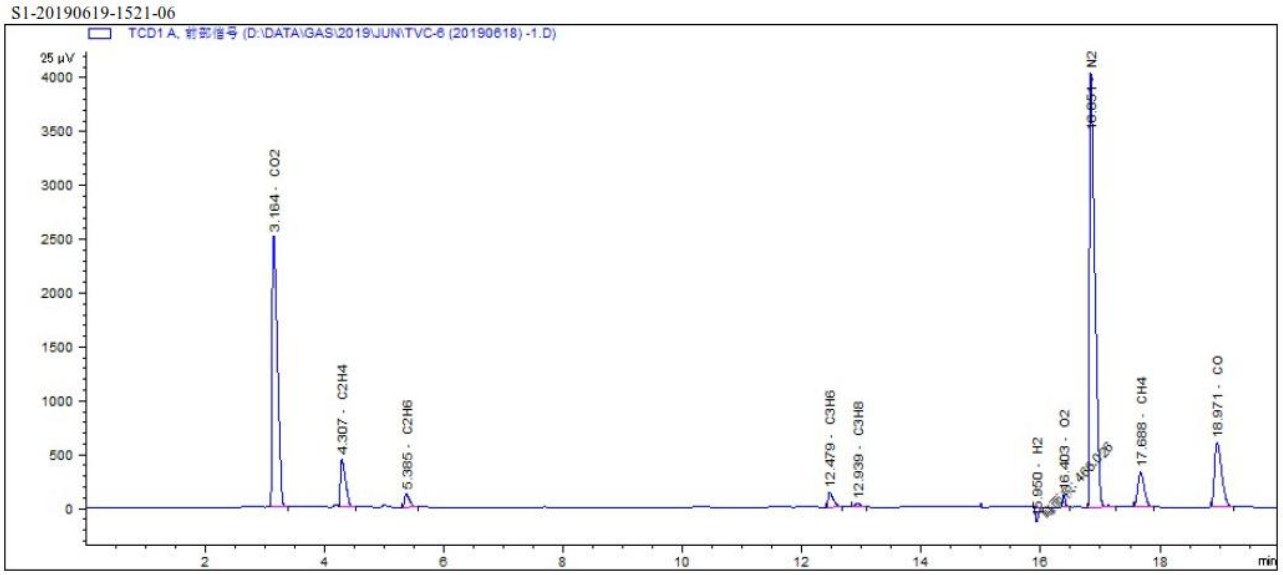
- GC-MS spectrogram analysis for gas before test : cell sample ID: 0818CAS01045



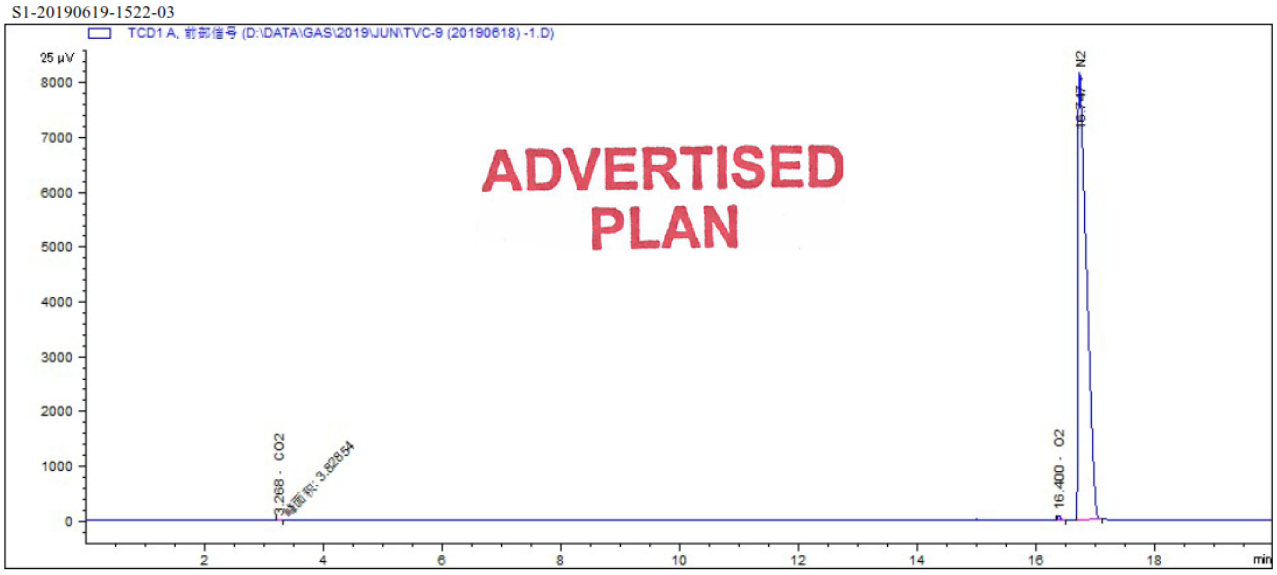
- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01045



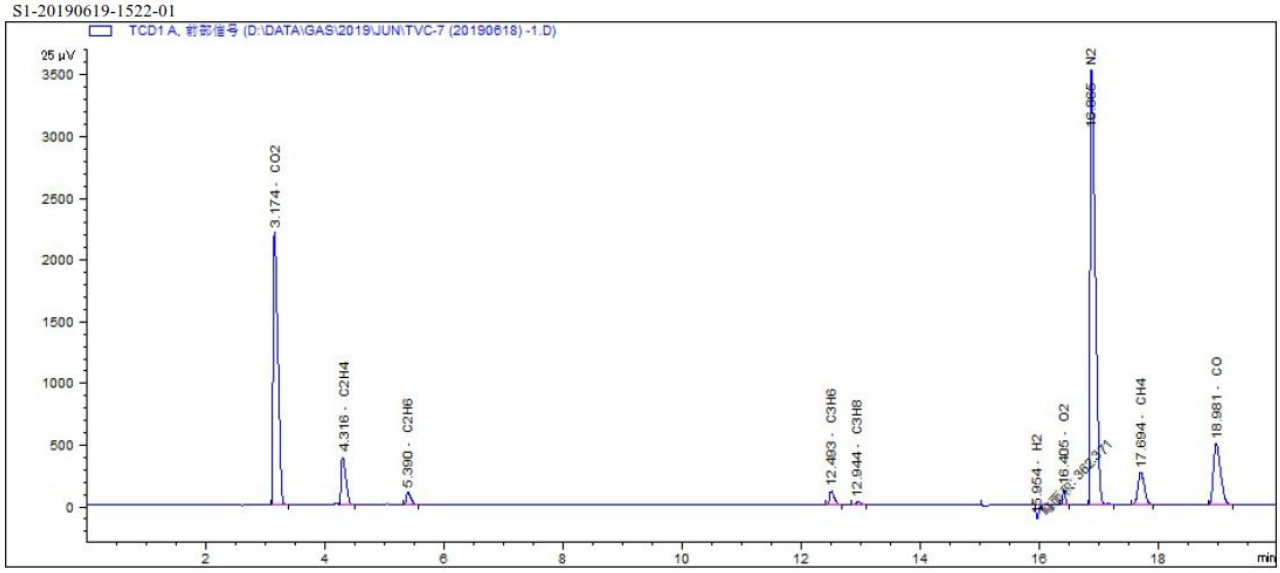
- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01045



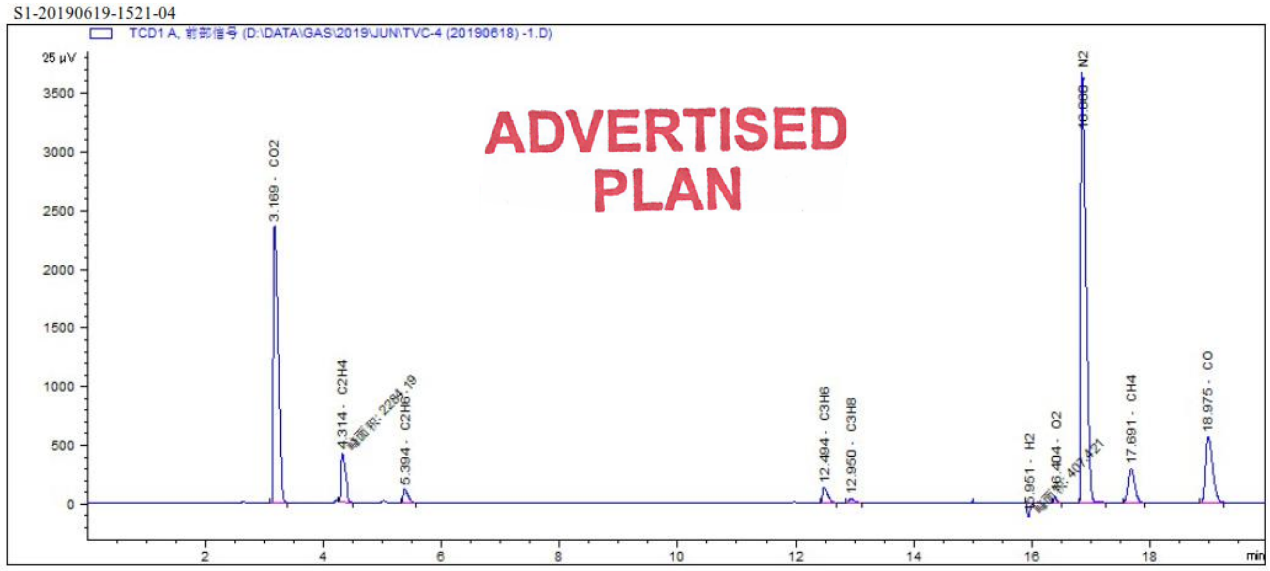
- GC-MS spectrogram analysis for gas before test : cell sample ID: 0818CAS01180



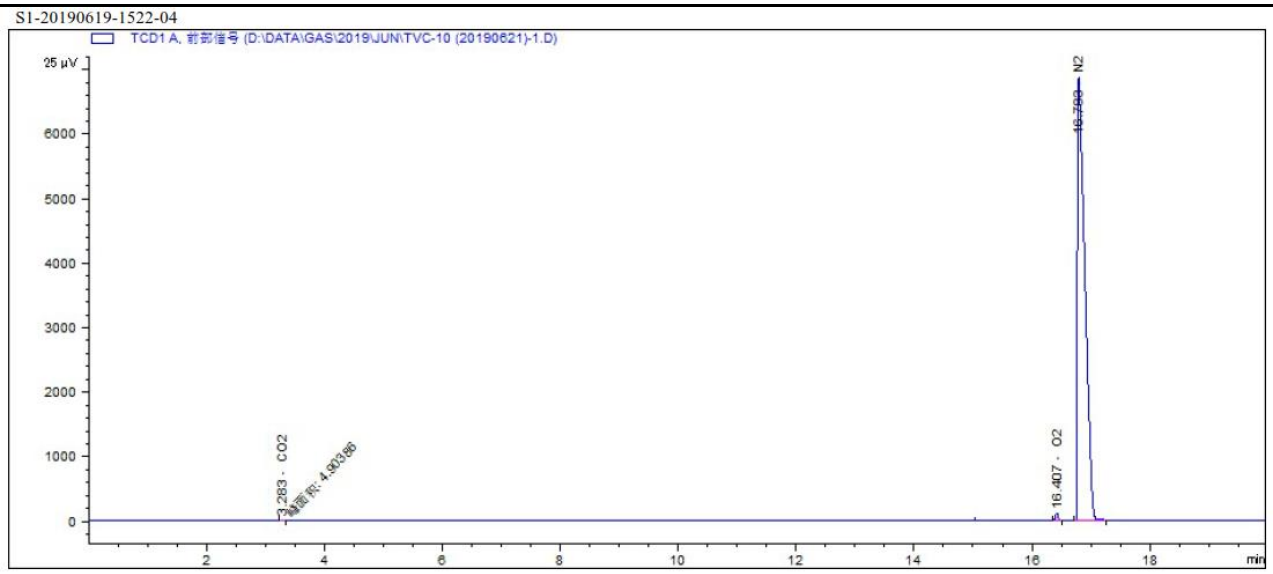
- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01180



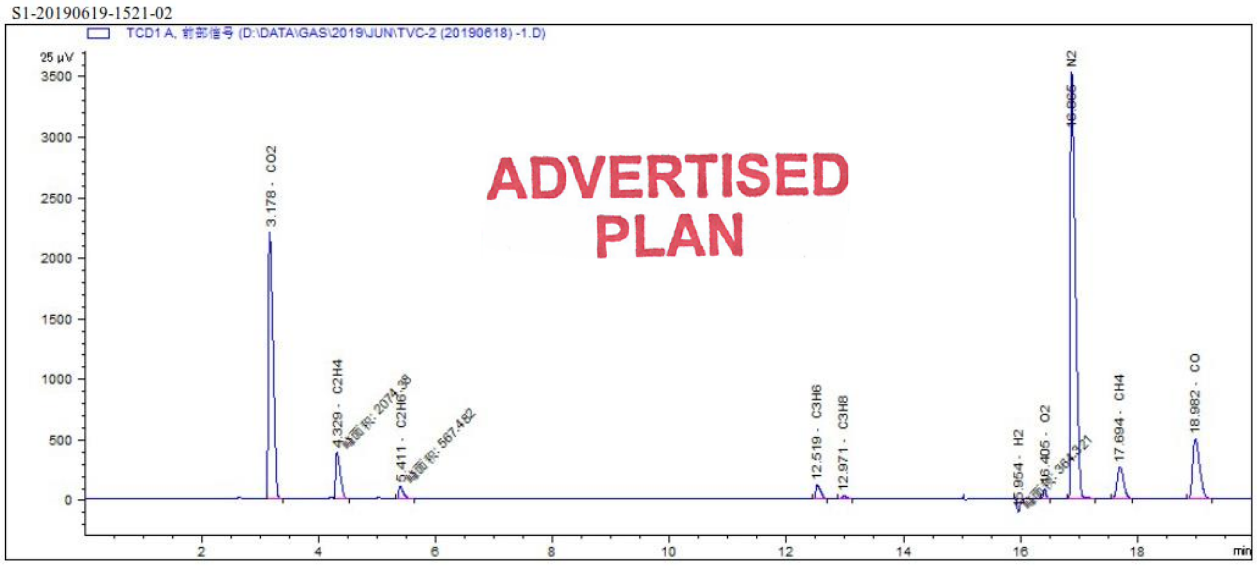
- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01180



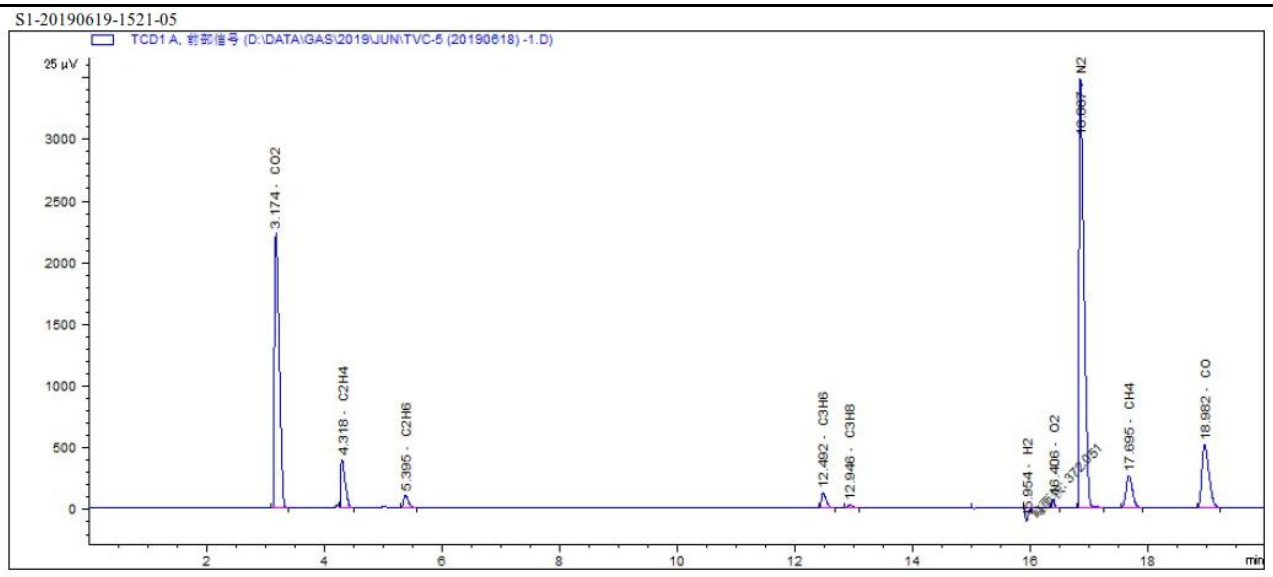
- GC-MS spectrogram analysis for gas before test : cell sample ID: 0818CAS01047



- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01047

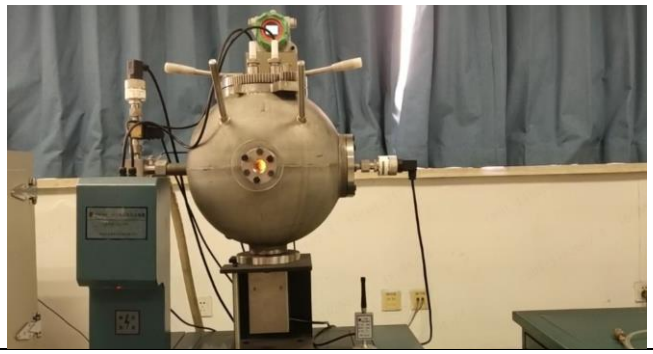


- GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01047



GC-MS spectrogram analysis for gas released after test: cell sample ID: 0818CAS01047

Gas Mixture During LFL Testing.



Gas Mixture during Explosion Pressure Testing

Synthesis method was used for preparing the gas mixtures in accordance to the above gas composition and concentration identified, and the information for gas samples was noted as below:

Cylinder No.	1814256				
Components name	Requested concentration	Certified Value	Unit	Relative Expended Uncertainity	Analytical Method
C3H8	0.39%	0.39%	mol/mol	±1%	GC-FID
C3H6	1.59%	1.59%	mol/mol	±1%	GC-FID
C2H6	1.35%	1.35%	mol/mol	±1%	GC-FID
C2H4	4.80%%	4.79%	mol/mol	±1%	GC-FID
CO2	28.7%	28.7%	mol/mol	±1%	GC-FID
CH4	4.62%	4.66%	mol/mol	±1%	GC-FID
CO	9.86%	9.85%	mol/mol	±1%	GC-FID
H2	Balance	Balance	mol/mol	±1%	GC-FID

The results for lower flammability level(LFL) of gas mixture at the cell venting temperature was noted as below in accordance to the requirement of ASTM E918-19, and the results was noted as below:

Measured LFL at cell venting temperature: 5.4%@143±1°C, 101±3kPa

Refer to below table for the details:

No.	c_s [%]	T_i [℃]	p_i [kPa]	p_{ex} [kPa]	p_{ex}/p_i	Ignition?
1	5.7	143.2	102.7	114.9	1.12	Y
2	5.5	143.0	102.5	109.0	1.06	Y
3	5.5	143.3	101.7	110.4	1.09	Y
4	5.3	143.3	101.3	106.1	1.05	N
5	5.3	143.3	100.0	102.5	1.02	N
6	5.3	143.3	102.0	103.7	1.02	N
Result	L_1=5.5%, L_2=5.3%, LFL=5.4% at 143(±1)℃ and 101(±2)kPa .					
Remark	The symbols used in this Attached Table are defined as below: L_1 ——The minimum sample concentration that gives flame propagation; L_2 ——The maximum sample concentration that does not give flame propagation; LFL is expressed as: LFL = $(L_1+L_2)/2$ It is considered explosion occurred, if $p_{ex}/p_i \geq 1.07$.					

Burning velocity of gas mixture released was done with the synthesis gas, sample No. 1814256 in accordance to the standard ISO 817: 2014, and the results was noted as below:

Measured burning velocity of gas mixture at room temperature (22~30°C) and atmospheric pressure: Su = 0.584m/s.

Refer to below table for the details.

No.	c_s [%]	S_S [m/s]	a_f [m^2]	A_f [m^2]	S_u [m/s]
1	11.0	0.192	0.00112	0.00323	0.066
2	12.0	0.190	0.00123	0.00323	0.072
3	16.9	1.269	0.00121	0.00696	0.220
4	20.0	1.615	0.00126	0.00779	0.260
5	24.0	1.418	0.00126	0.00329	0.542
6	25.0	1.500	0.00120	0.00309	0.584
7	25.0	1.500	0.00126	0.00337	0.560
8	26.0	1.200	0.00120	0.00266	0.544
9	27.0	1.500	0.00115	0.00324	0.535
10	28.0	1.125	0.00120	0.00274	0.494
11	28.1	1.255	0.00126	0.00323	0.488
12	29.0	1.167	0.00120	0.00271	0.519

Result	S_u= 0.584 m/s at room temperature and atmosphere pressure.
Remark	The symbols used in this report are defined as below except otherwise defined: S_S —— Flame propagation speed, a_f —— Cross-sectional area of flame bottom, A_f —— Flame surface area, S_u is calculated as $S_u = S_S \times \frac{a_f}{A_f}$.

Equipment Used: Item no. 6, 7, 8, 9, 10, 11, 12, 13
Date Start: 2019-06-03 (YY/MM/DD)
Date End: 2020-07-21 (YY/MM/DD)

TEST EQUIPMENT:

Item No.	Inventory Code / ID	Description	Manufacturer	Model	Range Used	Calibration Date (YYYY-MM-DD)	Next Calibration Due Date (YYYY-MM-DD)
1	74XWE00104	Battery Cycler	Xinwei	5V200A	0～5V，0～200A	2019-05-16	2020-05-15
2	L103319	Chamber	Hading	HLT702P	-35～80 ºC	2019-05-19	2020-05-18
3	72BAQ00382	Electronic Scale	Yingzhan	ALH-30	0~2.5kg	2018-11-20	2019-11-19
4	74OTE01427	Data Logger	HIOKI	LR8431	0~500 ºC, 0~10V	2019-04-08	2020-04-07
5	78BME00005	Perssure Conversion Equipment	Guangxi Xisen	BST6600-20TG	0~5MPa	2019-05-16	2020-05-18
6	L108248	GC-MS	Agilent	5977-7890B	-	2018-10-19	2020-10-18
7	16120801	Pressure Conversion Equipment for LFL tester	-	HM27A	0～20KPa, 0～5V	2019-03-12	2020-04-11
8	HY1706P20	Pressure Conversion Equipment for LFL tester(20L)	-	Hy1706P20	0~2MPa	2019-06-26	2020-06-25
9	HY100PA	Vacuum pressure sensor	-	HY100PA 20190604001	0~100KPa	2019-06-26	2020-06-25
10	PC073	Pressure Transducer	-	KJ16-734	-0.1~0.5MPa	2020-03-28	2021-03-27
11	PC074	Pressure Transducer	-	KJ16-734	0~35MPa	2020-03-28	2021-03-27
12	PC075	Pressure Transducer	-	KJ16-734	0~50MPa	2020-03-28	2021-03-27

Item No.	Inventory Code / ID	Description	Manufacturer	Model	Range Used	Calibration Date (YYYY-MM-DD)	Next Calibration Due Date (YYYY-MM-DD)
13	05230A1/12967	Oxygen Analyzer	SRVOMEX	MiniMP 5200	0~15%	2019-10-30	2020-12-23

---End of Report---