Gravimetric Isotherm Rig 3
重量法等温吸附仪介绍资料

目录

■ 功能：

煤岩/页岩重量法等温吸附测试

■ 产地：

澳大利亚

■ 优点：

（1）重量法测试可消除体积法中的累计误差，系统误差小；

（2）消除焦耳-汤姆孙效应，吸附速度快；

（3）样量100g±30g，且可以同时进行4个样品的干燥或平衡水条件等温吸附测试；

（4）配置抽真空系统，消除异类气体影响；

（5）自动化操作，且配备一键式保护系统。

（6）装卸样品方便快捷，10分钟左右即可完成。

■ 主要参数

（1）最大压力：35MPa，精度0.1%；

（2）最高温度：100℃，控制精度为 ±0.5 ℃，读数精度 0.1 ℃；

（3）样品重量： 100g±30g，视样品密度而定；重量可读性：0.001g；

（4）样品数量：4个，可同时进行4个样品测试；

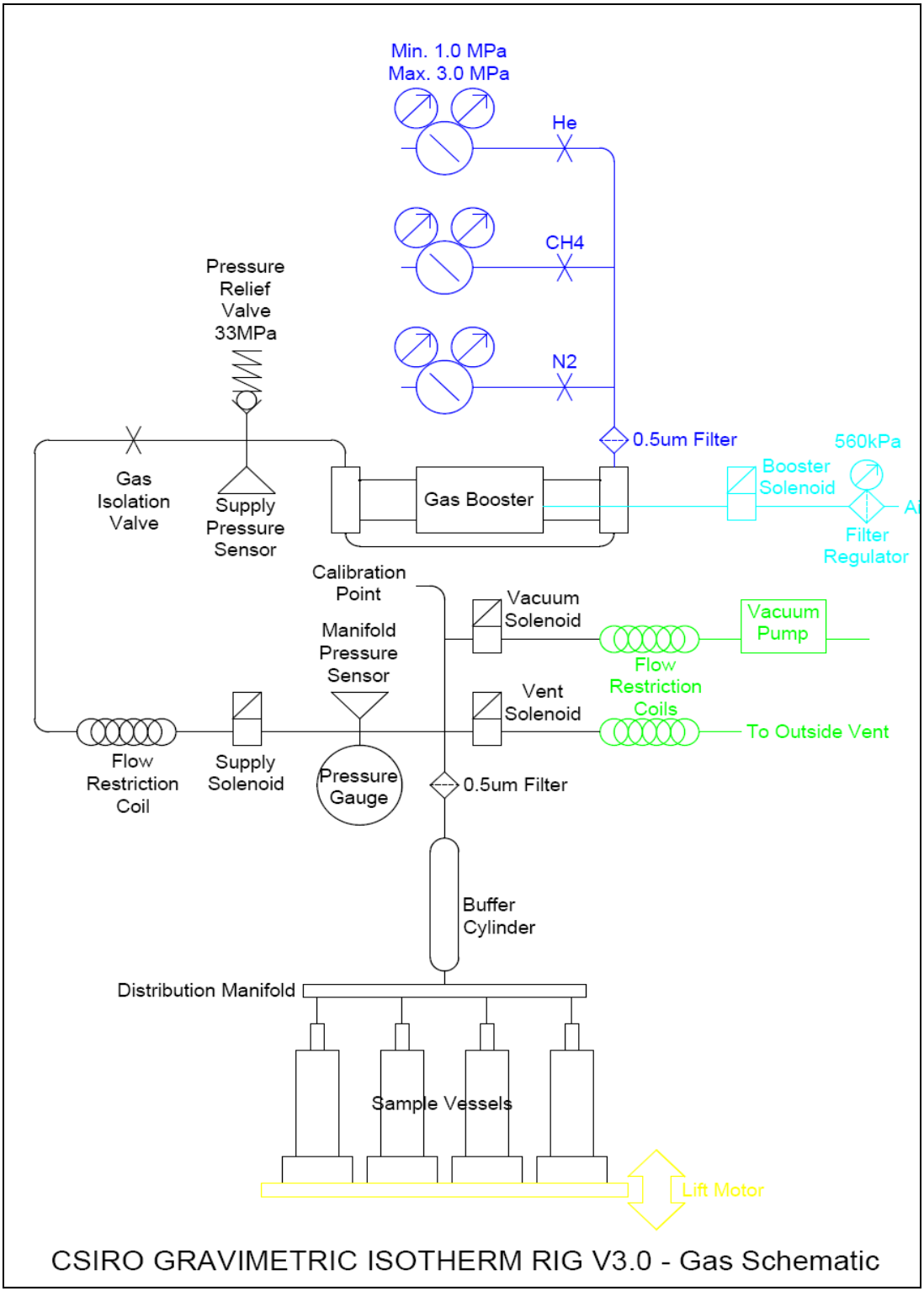
（5）安全警报系统：配有一键式停止系统，在甲烷泄露的情况下可以马上切断所有通向实验装置的电力供应确保安全。

（6）计算机控制系统： Microsoft Windows 7；Labview软件执行包提供对仪器所有功能全控制，包括吸附平衡判断，吸附过程中的进气量控制，仪器温度压力吸附重量变化的实时记录和显示。软件同时提供对吸附过程的手动控制功能。

（7）吸附等温曲线分析软件：软件由Microsoft Excel中的宏编制,计算兰氏吸附体积和兰氏吸附体积，并制订成实验报告打印。报告中包含实验时间，样品信息，实验结果以及兰氏吸附曲线的数据表和图等各项内容。

仪器外型照片

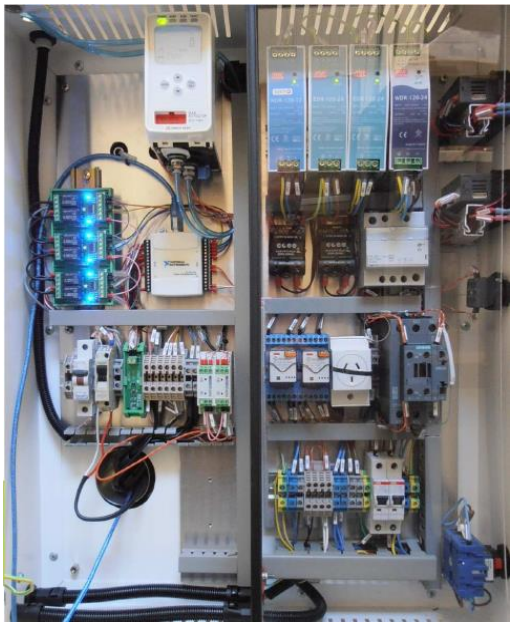
仪器结构示意图


Min. 1.0 MPa
Max. 3.0 MPa
He
CH4
N2
Pressure Relief Valve 33MPa
0.5um Filter
560kPa
Booster Solenoid
Filter Regulator
Gas Isolation Valve
Supply Pressure Sensor
Gas Booster
Calibration Point
Manifold Pressure Sensor
Vacuum Solenoid
Vacuum Pump
Flow Restriction Coils
Vent Solenoid
To Outside Vent
Flow Restriction Coil
Supply Solenoid
Pressure Gauge
0.5um Filter
Buffer Cylinder
Distribution Manifold
Sample Vessels
Lift Motor
CSIRO GRAVIMETRIC ISOTHERM RIG V3.0 - Gas Schematic

仪器内部结构

样品室

低电压电路控制室



高电压电路控制室

仪器使用手册

GRAVIMETRIC
ISOTHERM RIG V3.0

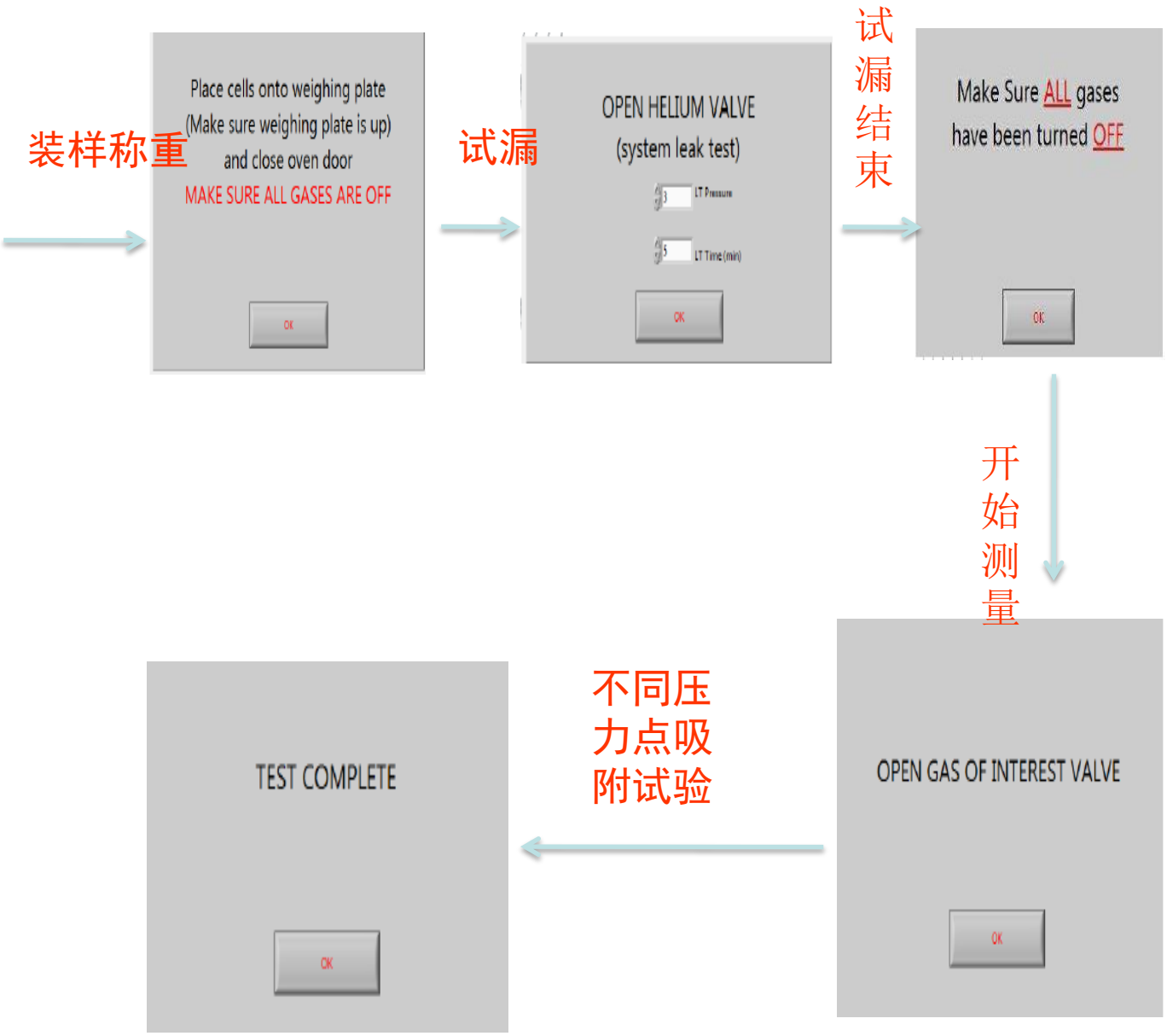
Gravimetric Isotherm Rig 3

Operating Instructions
Feb 2016

Commercial in confidence

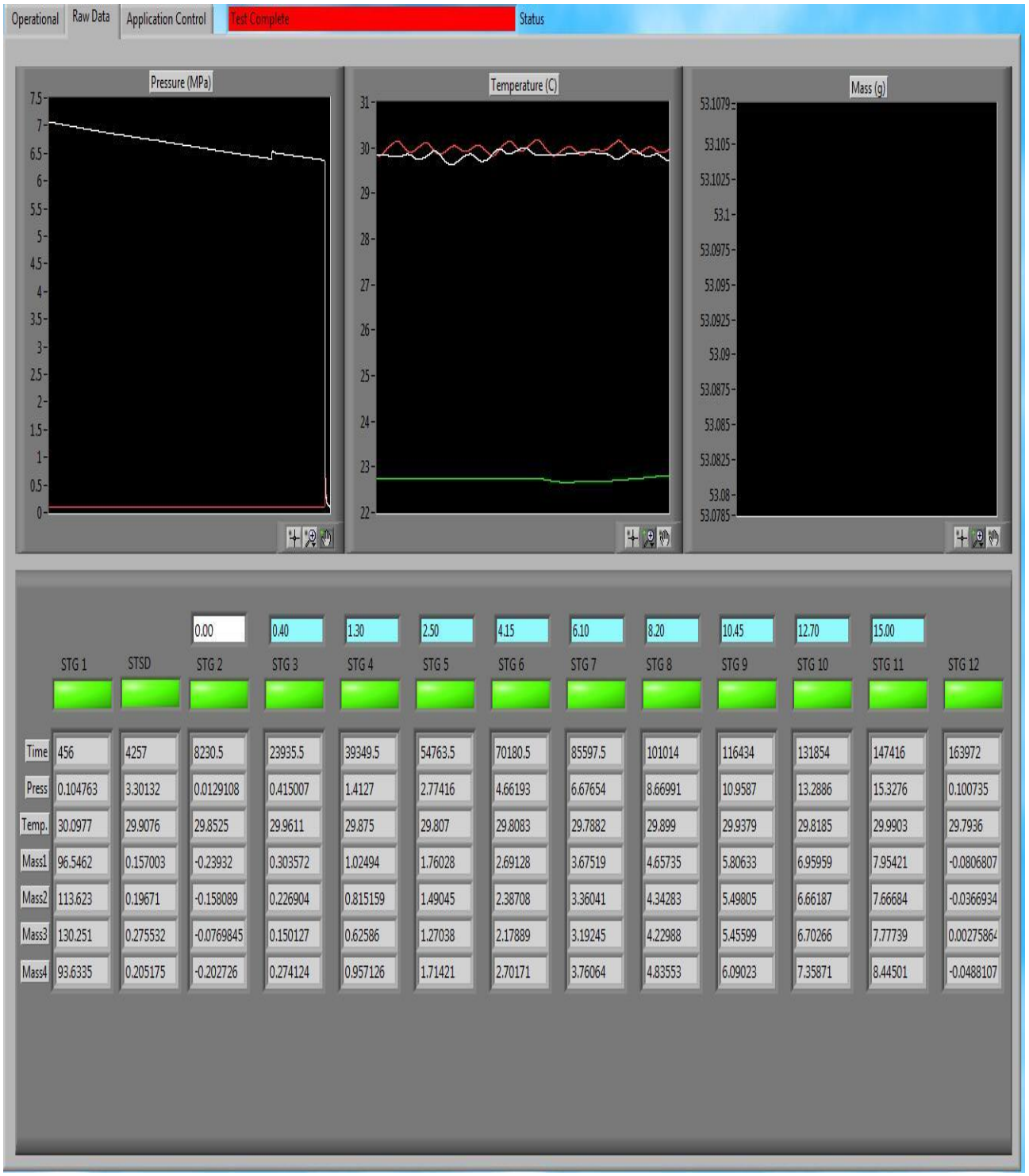
目录

实验测试流程

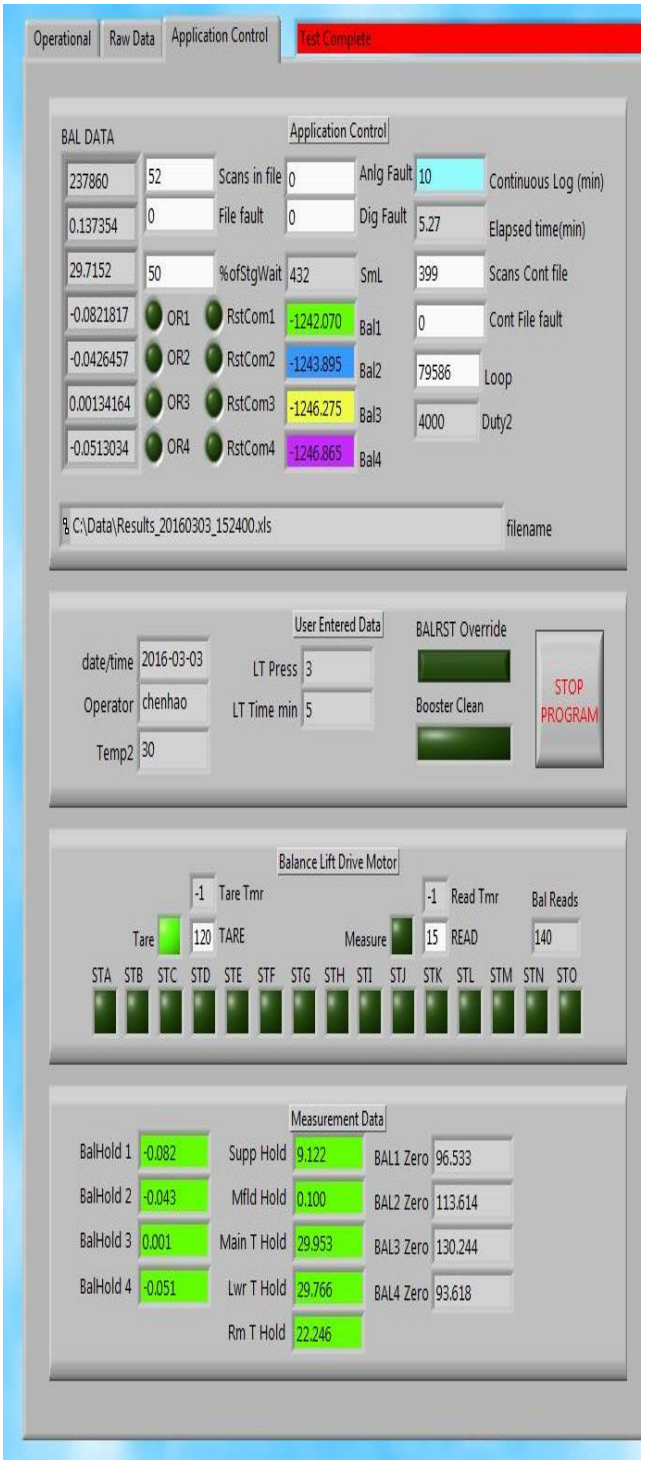

装样称重
Place cells onto weighing plate
(Make sure weighing plate is up)
and close oven door
MAKE SURE ALL GASES ARE OFF
OK
试漏
OPEN HELIUM VALVE
(system leak test)
LT Pressure
LT Time (min)
OK
试漏结束
Make Sure ALL gases
have been turned OFF
OK
开始测量
OPEN GAS OF INTEREST VALVE
OK
不同压力点吸附试验
TEST COMPLETE
OK

实验测试结果

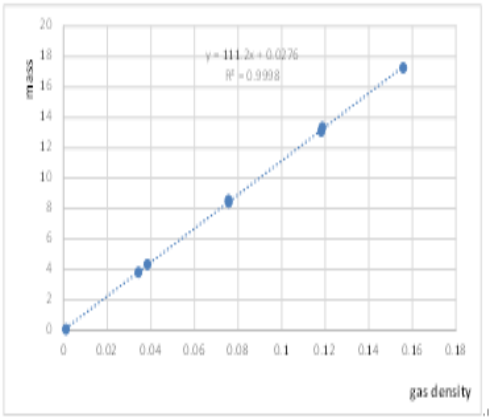
原始数据显示界面



控制系统显示界面



1、样品仓体积求取 V_{cell}



2、自由体积求取

$$V_{void} = V_{cell} - V_{sample} = Vcell - \frac{m_{sample}}{\rho_{sample}}$$

其中，样品质量由称重求得，密度由真密度仪测量

3、吸附量求取

过剩吸附量求取：$M = \rho_g V_{void} + M^{ex}_{ads}$

绝对吸附量：$M = \rho_g V_g + M^{abs}_{ads} = \rho_g (V_{void} - V_a) + \rho_a V_a$

$$M^{abs}_{ads} = M^{ex}_{ads} / (1 - \rho_g / \rho_a)$$

ρ_a:吸附态密度，甲烷取 0.421g/ml

ρ_g:自由状态下气体密度，根据 CH4DEN 函数求取

实验原始数据

Client				Client				Client				Client			
Sample #	CY1-5			Sample #	CY1-6			Sample #	CY1-7			Sample #	CY1-9		
Location				Location				Location				Location			
Well				Well				Well				Well			
Seam				Seam				Seam				Seam			
Depth				Depth				Depth				Depth			
Particle Size				Particle Size				Particle Size				Particle Size			
Moisture (AR)				Moisture (AR)				Moisture (AR)				Moisture (AR)			
Date	2016-03-16			Date	2016-03-16			Date	2016-03-16			Date	2016-03-16		
Operator	Dz			Operator	Dz			Operator	Dz			Operator	Dz		
Gas	Methane			Gas	Methane			Gas	Methane			Gas	Methane		
Temp	30.0			Temp	30.0			Temp	30.0			Temp	30.0		
Mass	116.0			Mass	126.9			Mass	70.6			Mass	156.6		
Bulk Dens				Bulk Dens				Bulk Dens				Bulk Dens			
Solid Dens	2.66		2.67321681	Solid Dens	2.69		2.45308432	Solid Dens	2.58		2.37752582	Solid Dens	2.65		2.67067907
Moisture (EQ)	11			Moisture (EC	12			Moisture (EC	13			Moisture (EC	14		
Ash	21			Ash	22			Ash	23			Ash	24		
Ads_C1_M	Ads_C1_P	Ads_C1_T	Ads_C1_Time	Ads_C2_M	Ads_C2_P	Ads_C2_T	Ads_C2_Time	Ads_C3_M	Ads_C3_P	Ads_C3_T	Ads_C3_Time	Ads_C4_M	Ads_C4_P	Ads_C4_T	Ads_C4_Time	
115.977	0.099	32.793	517.5	126.852	0.099	32.793	517.5	70.591	0.099	32.793	517.5	156.59	0.099	32.793	517.5	SM
-0.098	0.006	29.911	16237.5	-0.1	0.006	29.911	16237.5	-0.123	0.006	29.911	16237.5	-0.088	0.006	29.911	16237.5	
0.147	0.425	29.826	35842.5	0.145	0.425	29.826	35842.5	0.183	0.425	29.826	35842.5	0.153	0.425	29.826	35842.5	
0.633	1.411	29.896	54862.5	0.613	1.411	29.896	54862.5	0.778	1.411	29.896	54862.5	0.56	1.411	29.896	54862.5	
1.267	2.708	29.753	76084.5	1.218	2.708	29.753	76084.5	1.563	2.708	29.753	76084.5	1.068	2.708	29.753	76084.5	

实验测试报告

Adsorption Isotherm Test

中国石油勘探开发研究院廊坊分院
RESEARCH INSTITUTE OF PETROLEUM EXPLORATION & DEVELOPMENT-LANGFANG

Client:		**Gas:**	Methane
Well:		**Date:**	2016-02-24
Sample # :			
Depth (m):	541.45		

Moisture (% Eq):	0	**Mass (g):**	50.873
Moisture (% AR):		**Particle Size:**	
Ash Content (%):	0	**Analysis Temp (°C):**	45
He Density (g/ml):	2.05		

Langmuir Isotherm Coefficients

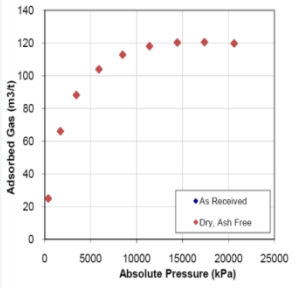
	P_L (kPa)	V_L (m^3/t)
As Received	1689.8	133.100
D.A.F.	1689.8	133.100

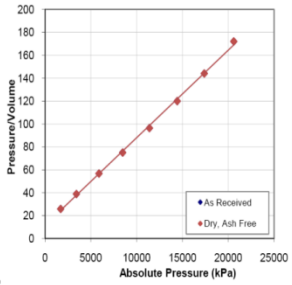
	P_L (psi)	V_L (scf/t)
As Received	245.1	4264.118
D.A.F.	245.1	4264.118

Results

Absolute Pressure (kPa)	Gas Adsorbed (cm^3/g)	Gas Adsorbed (d.a.f)
386.0	25.063	25.063
1711.0	66.080	66.080
3435.0	88.229	88.229
5899.0	103.918	103.918
8481.0	112.856	112.856
11394.0	118.038	118.038
14432.0	120.267	120.267
17381.0	120.547	120.547
20608.0	119.735	119.735

Absolute Pressure (PSI)	Gas Adsorbed (scf/t)	Gas Adsorbed (d.a.f)
55.985	802.94	802.94
248.160	2117.01	2117.01
498.205	2826.58	2826.58
855.578	3329.22	3329.22
1230.065	3615.56	3615.56
1652.560	3781.60	3781.60
2093.185	3853.01	3853.01
2520.901	3861.98	3861.98
2988.938	3835.96	3835.96





* Results reported at Standard Conditions of 15.6°C, 101.3kPa

活性炭测试报告

Adsorption Isotherm Test

中国石油勘探开发研究院廊坊分院
RESEARCH INSTITUTE OF PETROLEUM EXPLORATION & DEVELOPMENT-LANGFANG

Client:		**Gas:**	Methane
Well:	YSL21	**Date:**	2016-02-27
Sample # :	YSL21-2-1		
Depth (m):			

Moisture (% Eq):	0	**Mass (g):**	96.5447
Moisture (% AR):		**Particle Size:**	
Ash Content (%):	0	**Analysis Temp (°C):**	30
He Density (g/ml):	1.87		

Langmuir Isotherm Coefficients

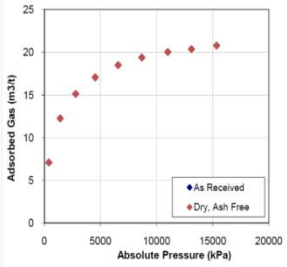
	P_L (kPa)	V_L (m^3/t)
As Received	1052.6	21.708
D.A.F.	1052.6	21.708

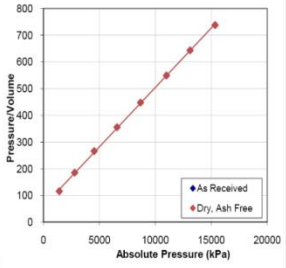
	P_L (psi)	V_L (scf/t)
As Received	152.7	695.452
D.A.F.	152.7	695.452

Results

Absolute Pressure (kPa)	Gas Adsorbed (cm^3/g)	Gas Adsorbed (d.a.f)
405.0	7.112	7.112
1415.0	12.266	12.266
2796.0	15.123	15.123
4538.0	17.063	17.063
6570.0	18.496	18.496
8680.0	19.393	19.393
10991.0	20.026	20.026
13099.0	20.356	20.356
15342.0	20.786	20.786

Absolute Pressure (PSI)	Gas Adsorbed (scf/t)	Gas Adsorbed (d.a.f)
58.740	227.86	227.86
205.228	392.98	392.98
405.526	484.51	484.51
658.181	546.64	546.64
952.898	592.56	592.56
1258.928	621.31	621.31
1594.110	641.59	641.59
1899.849	652.14	652.14
2225.169	665.91	665.91





* Results reported at Standard Conditions of 15.6°C, 101.3kPa

煤岩测试报告

Adsorption Isotherm Test

中国石油勘探开发研究院廊坊分院
RESEARCH INSTITUTE OF PETROLEUM EXPLORATION & DEVELOPMENT-LANGFANG

CSIRO

Client:		**Gas:**	Methane
Well:		**Date:**	2016-03-16
Sample # :	CY1-6		
Depth (m):			

Moisture (% Eq):	12	**Mass (g):**	126.852
Moisture (% AR):		**Particle Size:**	
Ash Content (%):	22	**Analysis Temp (°C):**	30
He Density (g/ml):	2.69		

Langmuir Isotherm Coefficients

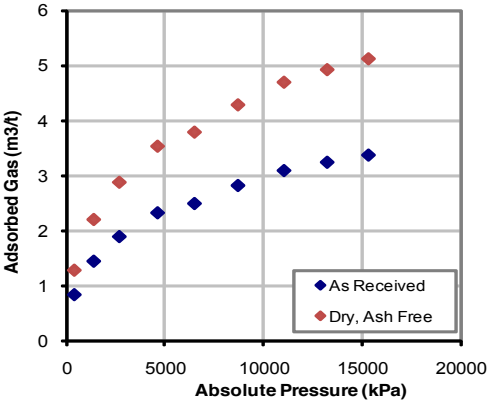
	P_L (kPa)	V_L (m^3/t)
As Received	2504.0	3.747
D.A.F.	2504.0	5.678

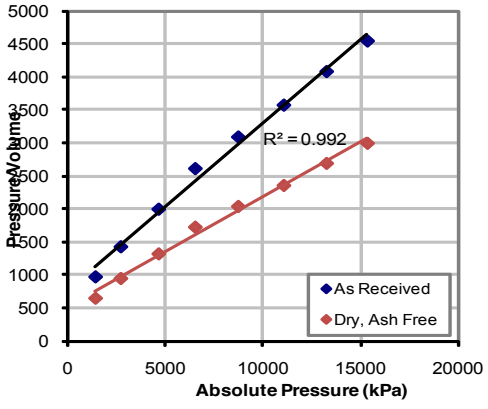
	P_L (psi)	V_L (scf/t)
As Received	363.2	120.053
D.A.F.	363.2	181.899

Results

Absolute Pressure (kPa)	Gas Adsorbed (cm^3/g)	Gas Adsorbed (d.a.f)
419.0	0.835	1.266
1405.0	1.445	2.189
2702.0	1.892	2.867
4644.0	2.325	3.523
6517.0	2.495	3.780
8724.0	2.823	4.277
11058.0	3.094	4.689
13249.0	3.245	4.917
15345.0	3.376	5.115

Absolute Pressure (PSI)	Gas Adsorbed (scf/t)	Gas Adsorbed (d.a.f)
60.771	26.76	40.54
203.778	46.29	70.13
391.892	60.62	91.84
673.555	74.49	112.86
945.211	79.92	121.09
1265.309	90.43	137.02
1603.827	99.14	150.21
1921.605	103.97	157.53
2225.604	108.16	163.87





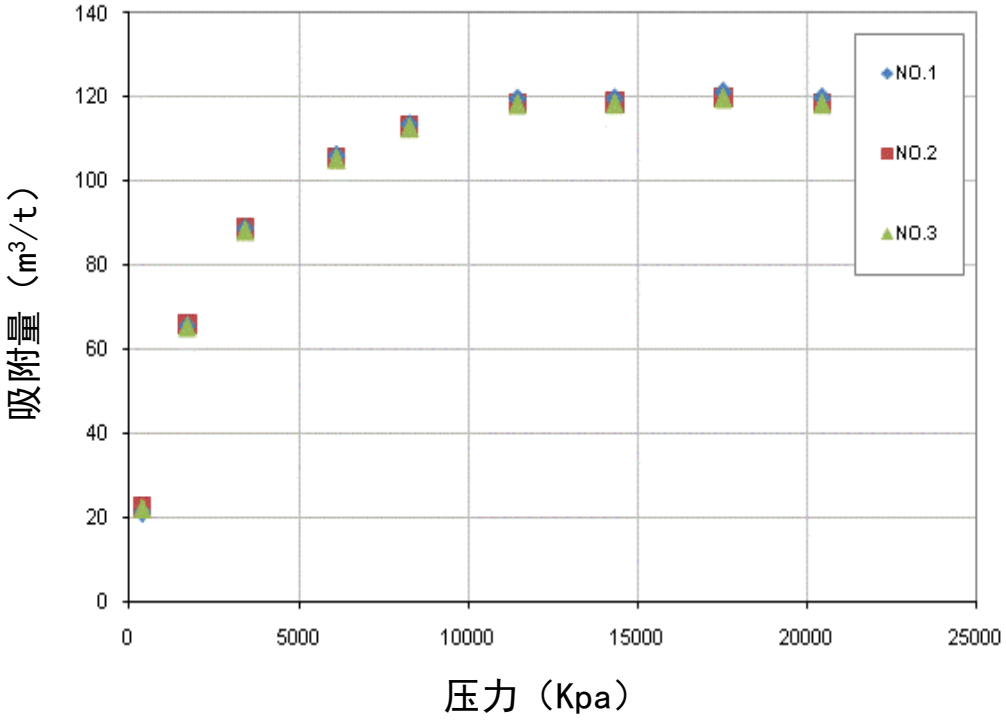
* Results reported at Standard Conditions of 15.6°C, 101.3kPa

页岩测试报告

CSIRO HTSH 恒泰尚合能源技术（北京）有限公司

准确性与重复性实验

用活性炭标样进行标定测试，结果显示仪器测试结果可靠，准确性高，重复性好



次数	PL（MPa）	VL（m³/t）
1	1.7559	134.63
2	1.6714	132.694
3	1.7012	132.711
误差（%）	4.81	1.44

活性炭样品测试结果

联系方式

恒泰尚合能源技术(北京)有限公司

■电话：

010-59505490　　13164265820 卓经理

■地址：

北京市昌平区北清路1号珠江摩尔国际大厦3号楼2-1612

■网址：

http://www.hengtaishanghe.com

http://www.instrument.com.cn/netshow/SH103271/

■邮箱：

htsh@hengtaishanghe.com