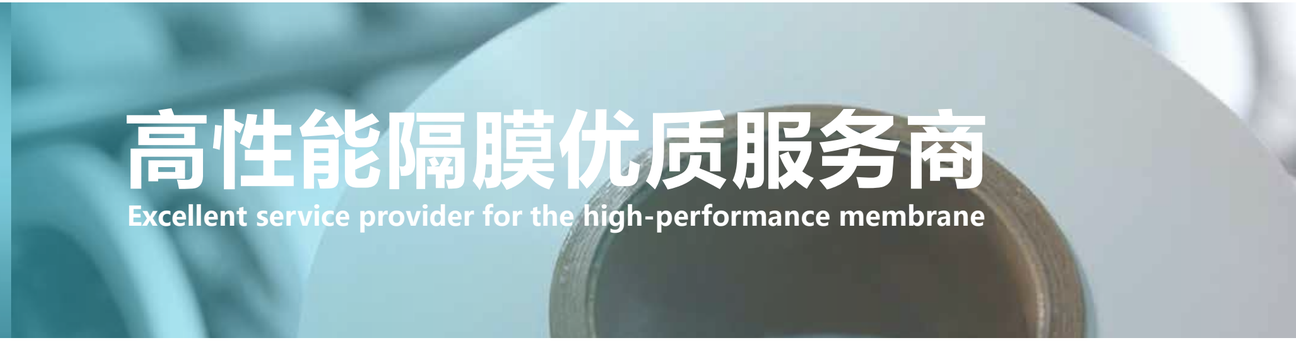
蓝科途

新材料　新生活
New materials New life



高性能隔膜优质服务商
Excellent service provider for the high-performance membrane

青岛蓝科途膜材料有限公司

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企业简介 Company Profile

青岛蓝科途膜材料有限公司成立于2016年，是青岛中科华联新材料股份有限公司控股子公司，注册资金2亿元。主要从事湿法锂电池隔膜的工艺研发、制品生产和销售服务，在功能性锂电复合隔膜方向可提供改性陶瓷涂覆隔膜、油性PVDF涂覆隔膜、新型芳纶涂覆隔膜等产品。

Established in 2016, Qingdao Lanketu Membrane Material Co., Ltd. is a holding subsidiary of Qingdao Zhongkehualian New Material Co., Ltd. with a registered capital of 200 million yuan. Mainly engaged in the research and development, production and sales services of wet lithium battery membrane. In the direction of functional lithium battery composite membrane, the company can provide modified ceramics coating membrane、oily PVDF coating membrane，and aramid coating membrane.

公司发展历程 Company History

2011
青岛中科华联新材料有限公司成立
Qingdao Zhongkehualian New Material Co., Ltd. was established

2012
购买102亩土地
Attained 102 mu of land

2012
隔膜生产线量产
Mass production of membrane production line

2014
第一条隔膜生产线交付客户
The first membrane production line is delivered to customer

2015
有限公司整体变更为股份有限公司
The company changed from limited Liability company to a joint stock limited company.

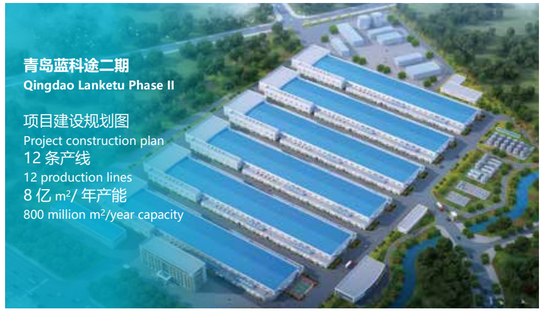
2016.12
注册设立控股子公司青岛蓝科途
Registered to set up a holding subsidiary Qingdao Lanketu

2018
注册设立全资子公司山西蓝科途
Registered to establish a wholly-owned subsidiary, Shanxi Lanketu

战略规划 Strategic Planning

公司厂区一期占地面积50亩，建设3条湿法锂离子电池隔膜生产线，年产量达1.5亿平方米，现已投产运营，并陆续与国内外多家知名电池企业达成合作。
随着锂离子电池应用范围的持续扩大，蓝科途持续扩大产能，2019年3月18日，青岛蓝科途膜材料有限公司新型湿法锂电池隔膜二期项目奠基仪式成功举办，标志着二期项目进入实质性建设阶段。

At the first phase, the factory covers an area of 50 mu, with three wet lithium ion battery membrane production lines and an annual output of 150 million square meters. It has been put into operation and has successively reached cooperation agreement with many well-known battery companies both domestic and abroad.
With the continuous expansion of the application range of lithium-ion batteries, Lanketu continued to expand production capacity. On March 18, 2019, the groundbreaking ceremony for the second phase of the new wet lithium battery membrane of Qingdao Lanketu Membrane Material Co., Ltd. was successfully held, marking the second phase of project entered into construction period.



产品介绍 Introduction to the products

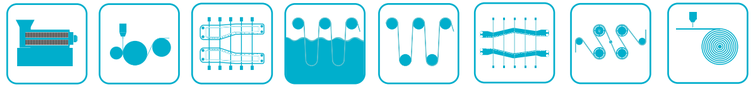
产线简介 Introduction to the production lines

公司拥有双向同步拉伸工艺以及双向异步拉伸工艺生产线,均为中科华联自主研发设计、自主生产、自主调试，设备精密性高，专业性强。

The company owns two kinds of production lines, biaxial synchronous stretching process and biaxial asynchronous stretching process, which both originated from Qingdao Zhongkehualian. The equipments have the advantages of high precision and strong expertise professionalism.

同步拉伸产品工艺示意图

Synchronous stretching product process diagram



异步拉伸产品工艺示意图

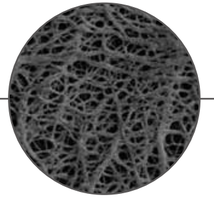
Asynchronous stretching product process diagram

产品介绍 Introduction to the products

产品分类 Product Categories

湿法隔膜基膜

Wet-mehod LIB membrane base membrane



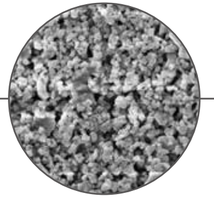
超薄隔膜 Ultra-thin membrane

高孔隔膜 High-porous membrane

高强隔膜 High-strength membrane

湿法涂覆隔膜

Coated membrane



陶瓷涂覆隔膜 Ceramics coated membrane

PVDF涂覆隔膜(水性、油性) PVDF coated membrane (aqueous, oily)

芳纶涂覆隔膜 Aramid coated membrane

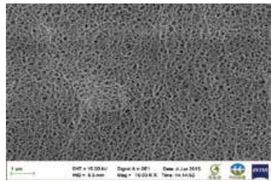
产品介绍 Introduction to the products

湿法隔膜基膜

Wet-mehod LIB membrane base membrane

蓝科途立足5-20μm湿法隔膜，产品具备厚度均匀性好、热收缩率小、拉伸强度高、耐穿刺、产品质量稳定、性能指标一致性好等优点。

Lanketu membrane products with the thickness of 5 to 20 μm, have excellent thickness uniformity, low thermal shrinkage rate, high stretching strength, and puncture resistance, stable product quality, excellent characteristics, etc.

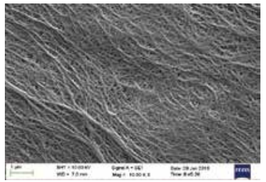


蓝科途产品表面形貌

均匀的孔隙率，稳定的透气性

The surface morphology of Lanketu Product

Even porosity and stable permeability.

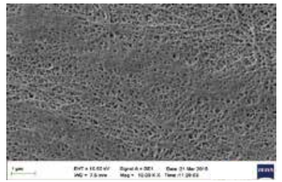


其他工艺样品 1

隔膜产生较粗的纤维束出现抱筋现象

Sample 1 prepared from the other process

The membrane produces thicker fibers , and the emergence of fiber hugging.

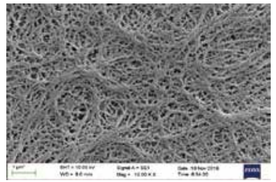


其他工艺样品 2

隔膜表面有闭孔现象

Sample 2 prepared from the other process

There are close of the holes on the membrane surface.



其他工艺样品 3

隔膜孔结构被破坏纤维束断裂

Sample 3 prepared from the other process

Destroyed pore structure and fractured fiber bundle.

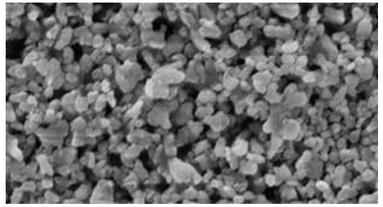
不同规格湿法隔膜基膜的物理性能指标

Physical properties of different models of LIB membranes fabricated with wet-method preparation technolgy

不同规格湿法隔膜基膜的物理性能指标

Physical properties of different models of LIB membranes fabricated with wet-method preparation

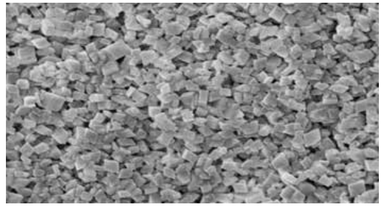
测试项目 Test items		7μm基膜 Base membrane	9μm基膜 Base membrane	12μm基膜 Base membrane		14μm基膜 Base membrane	16μm基膜 Base membrane			18μm基膜 Base membrane	20μm基膜 Base membrane	
厚度（μm） Thickness	偏差 Deviation	±1	±1	±1	±1	±1	±1	±1	±1	±1.5	±1.5	±1.5
透气性（s/100c） Permeability		150±40	150±40	240±40	180±40	220±40	300±40	200±40	180±40	220±40	240±40	200±40
拉伸强度（MPa） Stretching strength	TD	≥200	≥140	≥160	≥180	≥160	≥180	≥160	≥160	≥160	≥160	≥180
	MD	≥200	≥160	≥160	≥180	≥160	≥200	≥180	≥160	≥160	≥160	≥180
穿刺强度（g） Puncture resistance		≥450	≥435	≥500	≥600	≥550	≥600	≥600	≥600	≥700	≥800	≥900
105℃热收缩（%） Thermal contraction	TD	≤1.5	≤1.5	≤1	≤1	≤1	≤1	≤1.5	≤1.5	≤1.5	≤1.5	≤1.5
	MD	< 3	< 3	≤3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
120℃热收缩（%） Thermal contraction	TD	< 3.5	< 3.5	≤3	< 3	< 3	< 3	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5
	MD	≤6	< 6	≤6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
孔隙率（%） Porosity		36±5	39±5	38±5	40±5	40±5	38±5	43±5	45±5	45±5	45±5	42±5



陶瓷涂覆隔膜 The membrane coated with ceramic

陶瓷涂覆可提高隔膜的热稳定性、针刺强度、电解液浸润性，提升锂电池的安全性以及使用寿命。

Ceramic coating could improve the characteristics of LIB membrane,including the thermal stability, the puncture resistance , the wettablity to electrolyte, increasing its safety and ser -vice life.



勃姆石涂覆隔膜 The membrane coated with boehmite

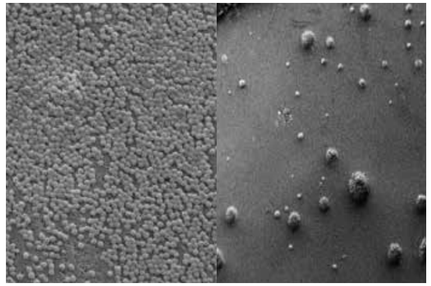
低自发电率	Low self-generation rate
循环寿命长	Long cycle life
降低设备磨损	Reduce equipment wear

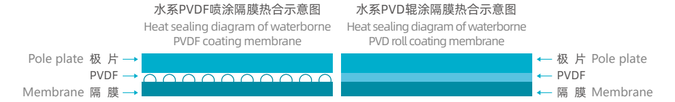
不同规格陶瓷涂覆隔膜的物理性能指标

Physical performance indicators of ceramic membranes of different specifications

测试项目 Test items		7μm基膜 Base membrane	9μm基膜 Base membrane	9μm基膜 Base membrane	12μm基膜 Base membrane	12μm基膜 Base membrane	16μm基膜 Base membrane
		陶瓷/勃姆石2+2 Ceramic / boehmite	陶瓷/勃姆石+3 Ceramic / boehmite	陶瓷/勃姆石2+2 Ceramic / boehmite	陶瓷/勃姆石2+2 Ceramic / boehmite	陶瓷/勃姆石+4 Ceramic / boehmite	陶瓷/勃姆石+2 Ceramic / boehmite
厚度（μm） Thickness	偏差 Deviation	11±1	12±1	13±1	16±1	16±1	18±1
透气性（s/100c） Permeability		200±40	180±40	200±40	230±40	220±40	220±40
拉伸强度（MPa） Stretching strength	TD	≥120	≥100	≥90	≥120	≥120	≥130
	MD	≥120	≥110	≥100	≥120	≥120	≥150
穿刺强度（g） Puncture resistance		≥450	≥435	≥435	≥600	≥600	≥600
120℃热收缩（%） Thermal contraction	TD	≤2	≤2	≤2	≤2	≤2	≤2
	MD	≤2	≤2	≤2	≤2	≤2	≤2
130℃热收缩（%） Thermal contraction	TD	≤2	≤3	≤2	≤2	≤2	≤3
	MD	≤2	≤3	≤2	≤2	≤2	≤3
水分（ppm） Moisture		≤600	≤600	≤600	≤600	≤600	≤600

产品介绍 Introduction to the products





浸润性 Infiltration	★★★★★	★★★
电极粘结性 Electrode adhesion	★★★	★★★★★
隔膜透气性 Membrane permeability	★★★★★	★★★

喷涂的涂覆膜因PVDF点之间存在空隙，给电解液的浸润提供了通道，而辊涂涂覆膜电解液只能通过颗粒间间隙浸润。

The sprayed coating membrane provides a channel for the infiltration of the electrolyte due to the gap between the PVDF points, and the roll coating membrane electrolyte can only infiltrate through the inter-particle gap.

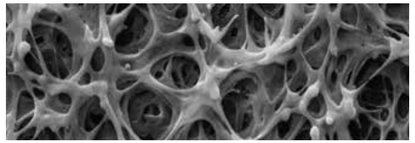
水性PVDF涂覆隔膜 The membrane coated with waterborne PVDF

隔膜与电极粘结效果好	Good adhesion between the membrane and the electrode
较好的浸润性	Better infiltration
高分解电压	High decomposition voltage
可应用到高电压材料体系	Can be applied to high voltage material systems
提高吸液保液率	Increase the liquid retention rate

不同规格水性PVDF/陶瓷涂覆隔膜的物理性能指标（辊涂/喷涂）

Physical properties of water-based PVDF/ceramic membranes of different specifications (roller coating/spraying)

测试项目 Test items		9μm基膜 Base membrane	12μm基膜 Base membrane	16μm基膜 Base membrane
		PVDF9+3+1+1	PVDF12+4+1+1	PVDF16+2+1+1
厚度（μm）Thickness	偏差 Deviation	±1	±1	±1
透气性（s/100c）Permeability	喷涂 Spraying	200±40	240±40	240±40
	辊涂 Roll coating	250±40	290±40	290±40
拉伸强度（MPa）Stretching strength	TD	> 100	> 110	> 120
	MD	> 100	> 110	> 140
穿刺强度（g）Puncture resistance		> 435	> 600	> 600
105℃热收缩（%）Thermal contraction	TD	≤1	≤1	≤1
	MD	≤1	≤1	≤1
120℃热收缩（%）Thermal contraction	TD	≤2	≤2	≤2
	MD	≤2	≤2	≤2



油性PVDF涂覆隔膜 The membrane coated with oliy PVDF

提高电池硬度，增加安全等级	Improve battery hardness and increase safety level
减少老化导致的强度降低和副反应	Reduces the intensity reduction and side reactions of aging
提升吸液保液率	Increase the liquid retention rate

油性PVDF涂覆隔膜的物理性能指标（分层涂）

Physical indicators of oily PVDF membrane (delamination coating)

测试项目 Test items		7μm基膜 Base membrane	9μm基膜 Base membrane	12μm基膜 Base membrane	9+3μm陶瓷膜 Ceramic membrane	12+4μm陶瓷膜 Ceramic membrane
		PVDF 1+1	PVDF 1+1	PVDF 1+1	PVDF 1+1	PVDF 1+1
厚度（μm）Thickness	偏差 Deviation	9±1	11±1	14±1	14±1	16±1
透气性（s/100c）Permeability		170±40	220±40	250±40	250±40	280±40
拉伸强度（MPa）Stretching strength	TD	≥130	≥140	≥140	≥140	≥140
	MD	≥150	≥160	≥160	≥160	≥170
穿刺强度（g）Puncture resistance		≥300	≥450	≥550	≥500	≥550
105℃热收缩（%）Thermal contraction	TD	≤2	≤2	≤2	0	≤1
	MD	≤3	≤3	≤3	≤1	≤1
130℃热收缩（%）Thermal contraction	TD	/	/	/	≤2	≤1.5
	MD	/	/	/	≤2	≤2
面密度（g/m²）Areal density		5.8-6.4	6.9-7.7	7.7-9.9	10.2-11.5	14.5-17

油性PVDF涂覆隔膜的物理性能指标（混涂）

Physical indicators of oily PVDF membrane (mixed coating)

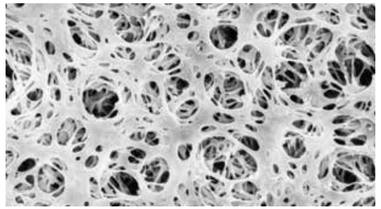
测试项目 Test items		9μm基膜 Base membrane	9μm基膜 Base membrane
		9+2+2双面涂覆（常规型号）Double sided coating (conventional model)	9+3+3双面涂覆（快充高倍率型）Double-sided coating (fast charge high magnification type)
厚度（μm）Thickness	偏差 Deviation	13±1	15±1
透气性（s/100c）Permeability		190±30	120±30
拉伸强度（MPa）Stretching strength	TD	≥140	≥80
	MD	≥160	≥50
穿刺强度（g）Puncture resistance		≥500	≥300
130℃热收缩（%）Thermal contraction	TD	≤3	≤5
	MD	≤4	≤5
面密度（g/m²）Areal density		6.5±1	7.5±1

· 蓝科途油性PVDF涂覆隔膜在进行大厚度（双面总涂层≥6μm）涂覆时，仍然保留了基膜良好的通透性，双面涂覆+6μm，透气值增加值≤40s/100c。

· 油性PVDF混涂对隔膜的透气性影响较分层涂影响更小一些。

· Lanketu oily PVDF coated membrane retains good permeability of the base membrane when it is coated with large thickness (double-sided total coating ≥6μm), double-sided coating +6μm, and the value of permeability increase is ≤40s/100c.

· The effect of oily PVDF mixed coating on the permeability of the membrane is less than that of the delamination coating.



优势 Advantage	湿法+芳纶涂覆 Wet + aramid coating
耐热性 Heat resistance	使隔膜耐热性能大幅提升，实现了闭孔特性和耐热性能的两者兼备 The membrane heat resistance has been greatly improved to achieve both the characteristics of pore closing and heat resistance.
浸润性 Wettability	提高对电解液的浸润性，从而延长电池的循环寿命 Improving the membrane wettability to he electrolyte, which will be beneficial to extend the cycle life of the battery.
抗氧化性 Antioxidant properties	提高了隔膜的抗氧化性，这种优异的抗氧化性有助于实现高电位化，从而提高能量密度 Improving the antioxidant properties of the membrane, this excellent oxidation resistance helps to achie -ve high potential and energy density.

不同规格芳纶涂覆隔膜的物理性能指标

Physical indicators of aramid coating membrane with different specifications

测试项目 Test items		9μm+3分层涂覆 Delamination coating	12μm+4分层涂覆 Delamination coating	9μm+2+2混合涂覆 Mixed coating
		芳纶单面 Aramid single side	芳纶单面 Aramid single side	芳纶双面 Aramid double sided
厚度（μm）Thickness	偏差 Deviation	12±1	16±1	13±1
透气性（s/100c）Permeability		200±30	240±40	200±40
拉伸强度（MPa）Stretching strength	TD	≥100	≥120	≥80
	MD	≥110	≥120	≥80
穿刺强度（g）Puncture resistance		≥435	≥600	≥250
130℃热收缩（%）Thermal contraction	TD	≤2	≤2	≤2
	MD	≤2	≤2	≤2
150℃热收缩（%）Thermal contraction	TD	≤3	≤3	≤3
	MD	≤3	≤3	≤3
180℃热收缩（%）Thermal contraction	TD	≤5	≤5	≤5
	MD	≤5	≤5	≤5
TMA（℃）		/	/	≥300

湿法隔膜、涂覆隔膜性能对比

Performance comparison of wet membrane and coated membrane

测试项目 Test items	湿法隔膜基膜 Wet-mehod LIB base membrane	基膜+PVDF涂覆 Base membrane+PVDF coating	基膜+陶瓷涂覆 Base membrane+ceramic coating	基膜+芳纶涂覆 Base membrane+aramid coating
厚度均匀性 Thickness Uniformity	★★★★	★★★★	★★★★	★★★★
拉伸强度 Stretching resistance	★★★★	★★★½	★★★½	★★★½
穿刺强度 Puncture resistance	★★★★	★★★★½	★★★★½	★★★★½
透气性 Permeability	★★★★★	★★★★½	★★★★½	★★★★
热稳定性 Thermal stability	★★★	★★★★	★★★★★	★★★★★
润湿性 Wettability	★★★★	★★★★★	★★★★★	★★★★★
电池能量密度 Battery energy density	★★★★	★★★★★	★★★★★	★★★★★
生产成本 Production costs	★★★	★★★★	★★★★	★★★★★

品质保证 Quality Assurance

职业健康安全管理体系认证证书
Occupational Health and Safety Management System Certification

质量管理体系认证证书
Quality Management System Certificate

环境管理体系认证证书
Environmental Management System Certificate

质量管理体系符合性证明
Quality management system compliance certificate

蓝科途先后完成了ISO9001质量管理体系认证、ISO14001环境管理体系认证，通过物料检验、在线监测、成品检验、电芯测试、隔膜管理系统等不断强化管理、严格考核、提升产品质量，打造具有国际品质的国产湿法高端隔膜。

Lanketu has completed ISO9001 quality management system certification and ISO14001 environmental management system certification. Through material inspection, online monitoring, finished product inspection, battery testing, membrane online management system, etc.it has continuously strengthened management, specified assessment, and improved product quality to create a domestic high-end wet membrane of international quality standard.

来料物检
Testing of raw materials

- 白油 White oil
- PE粉 PE powder
- 二氯甲烷 Dichloromethane

在线检测
online testing

- 在线测厚瑕疵 Online thickness measurement
- 控制点循环检测 Control point loop detection

线下检测
Offline testing

- 热收缩 Thermal stability
- 透气性 Permeability
- 孔隙率 Porosity
- 隔膜厚度 Thickness
- 穿刺强度 Puncture strength
- 拉伸强度 Stretching Strength

合规检测
Compliance testing

- 弧度 Radian
- 膜面 Membrane surface
- 塌边 Collapse
- 波浪边 Wave edge
- 端面 End face
- 宽度 Width

人员配置
Staffing

- 仓库管理 Warehouse management
- 包装管理 Packaging management
- 发货管理 Delivery management

品质保证 Quality Assurance

蓝科途拥有全套电池制作及测试仪器，以及扫描电镜（SEM）、激光粒度仪、FTIR光谱仪、热示差扫描仪、压汞式孔径测试仪、隔膜平整度张力测量仪等先进的检测仪器，有效保障隔膜成品质量。

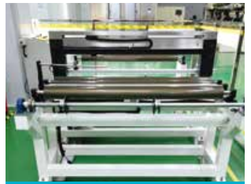
Lanketu has a full set of battery manufacturing and testing equipment, as well as scanning electron microscopy (SEM), laser particle size analyzer, FTIR spectrometer, thermal differential scanner, mercury intrusion aperture tester, membrane flatness tension gauge and other advanced testing instruments, effectively guarantee the quality of the finished membrane.

孔径分布

Pore size distribution

压汞仪

Mercury intrusion meter



褶皱、抱筋、塌边、轮胎印检测

Folds, ribs, sag, tire print detection

隔膜平整度张力测量仪

Membrane flatness tension measuring instrument

孔结构

Pore structure

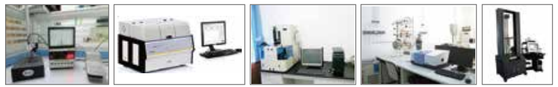
扫描电镜

Scanning electron microscope

样品测试分析仪器
Sample testing and analysis equipment

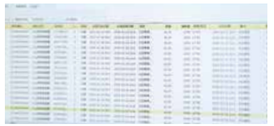
原料检测分析仪器
Equipments for testing and analysisof raw materials

膜性能测试分析仪器
Equipments for evaluating the characterizes



其他测试分析仪器
The other analysis instruments

产线智能管理



为提升产品品质、降低成本、打造数字化生产车间，蓝科途自主研发了一套隔膜线信息管理系统，主要包括品质保证、车间管理、产品追溯等三大模块。“锂离子电池隔膜信息管理系统”获得“2014年度中国制造业精细化生产管理最佳实践奖”。

To enhance the quality of products, reduce costs, build digital production workshop, Lanketu has independently researched and developmented a set of membrane line information management system, including financial accounting system, management of the quarkey assurance system and workshop site managemant. March 19, 2015, "the LIB membrane information management system" obtained "2014 China's manufacturing industry fine production management best practice award".

BPM/BI系统

协同办公、决策分析
Collaborative office decision analysis

ERP系统

企业资源管理
Manufacturing executive management

MES系统

制造执行管理
Enterprise resource management

PLC系统

现场自动化控制
Site automation control

中国湿法锂电池隔膜装备制造基地
China wet lithium battery membrane equipment manufacturing base

青岛市中小企业专精特新产品（技术）
Qingdao SME specialization special new products (technology)

新旧动能转换重大项目
New and old kinetic energy conversion major projects

2018年山西省重点工程
Key Project of Shanxi Province in 2018

青岛市2018年重点项目
Qingdao Key Project of 2018

获多项国家发明专利、实用型新型专利，被纳入省、市级重点项目

Received a number of national invention patents and practical new type patents, and were included in provincial and municipal key projects.

2017年

· 荣获“中国湿法锂电池隔膜装备制造基地·中科华联”
· 荣获“青岛市中小企业专精特新产品（技术）”证书

2018年

· 蓝科途新能源锂电池隔膜项目列入“青岛市2018年重点项目”
· 蓝科途新能源锂电池隔膜项目纳入“山东省新旧动能转换重大项目库”
· 山西蓝科途锂电池隔膜项目列入“2018年山西省重点工程”

2017

· Won the "China Wet Lithium Battery Membrane Equipment Manufacturing Base · Zhongkehualian"
· Awarded the “Qingdao SME Specialized Special New Product (Technology)” Certificate

2018

· Lanketu New Energy Lithium Battery Membrane Project was included in “Qingdao 2018 Key Project”
· Lanketu New Energy Lithium Battery Membrane Project was included in the “ Shandong New and Old Kinetic Energy Conversion Project Library”
· Shanxi Lanketu Lithium Battery Membrane Project was included in the “key project of Shanxi Province in 2018”

蓝科途通过大量的研发投入不断提升电池隔膜的技术水平

Lanketu has continuously improved the technical level of membrane through a large amount of research and development investment.

· 新建成的研究所实验楼占地面积2400m²
· 中试研发车间占地面积3600m²
· 组建了50余名包括高分子材料成型加工装备、高分子材料、化工过程与自动化、工程设计与服务为框架的研发团队。

· The newly built research building covers an area of 2400 square meters
· The middle trial run workshop covers an area of 3600 square meters
· Setup a R&D team of more than 50 employees under the framework of polymer material processing equipment, polymer materials, chemical process and automation, engineering design and service.

双螺杆混炼挤出机
Twin screw extruder

多功能双向拉伸试验机
Multifunctional Biaxial tensile test machine

配料系统 → 挤出系统 → 激冷辊 → 收卷机 ⇢ 手帕机 ⇢ 萃 取 ⇢ 干 燥 ⇢ 样 品

Batching system → Extrusion system → Sharp cooling rolls → Winding machine ⇢ Handkerchief machine ⇢ Extraction ⇢ Drying system ⇢ Sample

→ 连续过程Continuous process　⇢ 非连续过程Discontinuous process

公司建有锂离子电池隔膜实验线，可通过此实验线对隔膜的配方以及工艺参数做出调整优化验证，不断提高隔膜品质。

There is a Lab-scale LIB membrane production line, which could be used for the optimizations of the formula and process, improving the membrane q-uality continually.

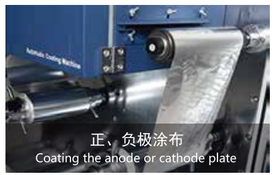
在研发成果方面目前已申请国家专利47项，其中已授权发明专利15项、实用新型专利32项。

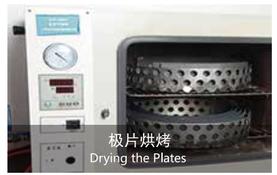
As for the achievement of R & D, 47 national patents have been authorized, including 15 invention patents and 32 utility model patents.

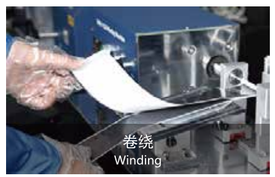
锂离子电池实验室 Laboratory for assembly of LIB

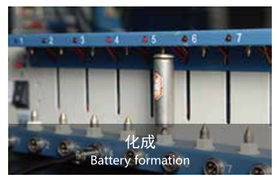
本实验室拥有生产圆柱电池、软包电池、扣式电池的全套生产设备及相关检测仪器，为公司现有隔膜进行电池性能检测，并根据结果对工艺做出调整，从而对隔膜的性能做出改善。

The laboratory has a full set of production equipment and related testing equipment for the production of cylindrical batteries, packed batteries and button batteries, testing for the company's existing membrane and adjustment of the process according to the results, thereby improving the performance of the membrane.









新材料　新生活

New materials New life