ANFA Conference

European regulations impacting biodegradability of nonwoven products

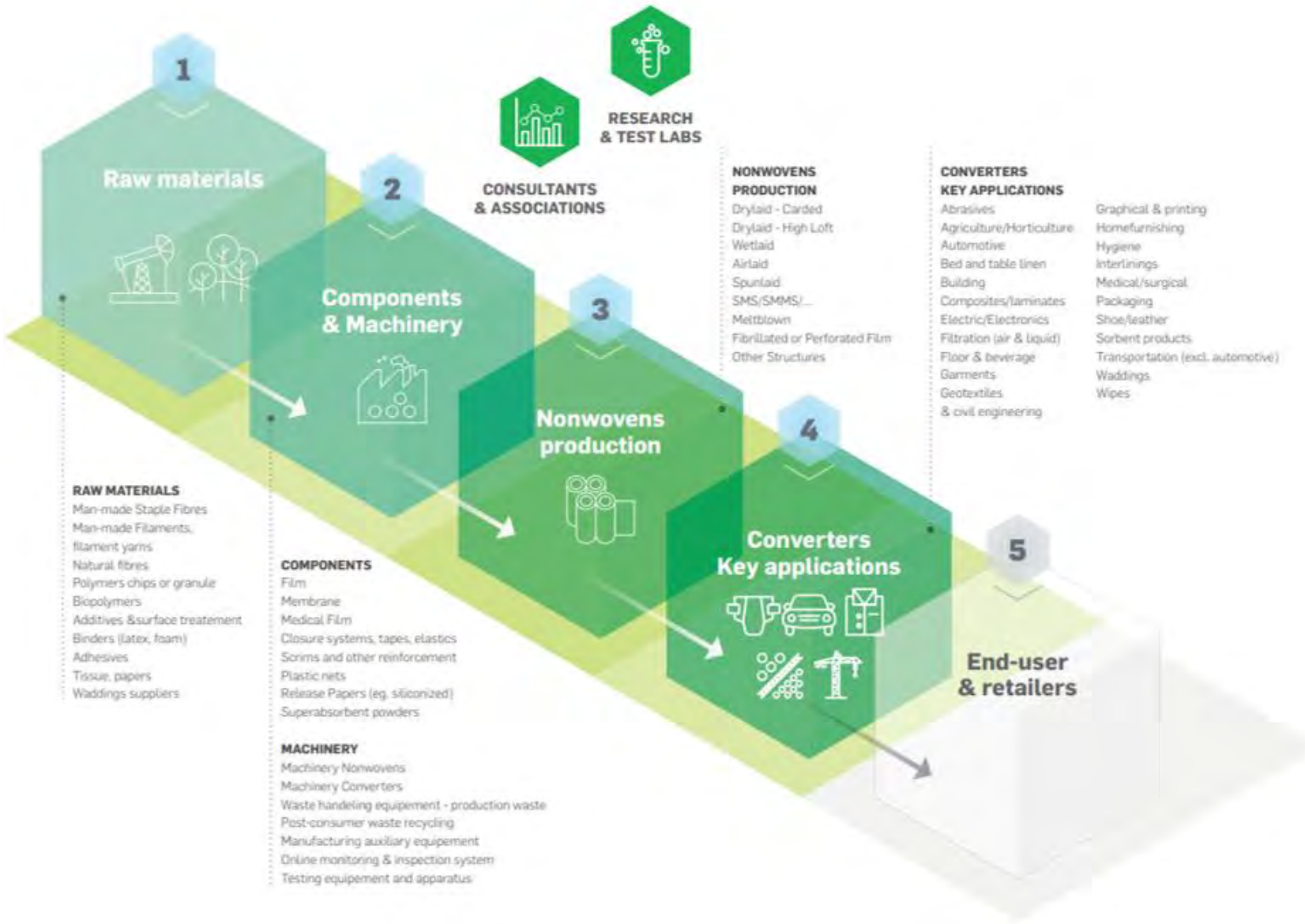
Murat Dogru

edana
The voice of NONWOVENS

Who we are

THE ENTIRE NONWOVENS VALUE CHAIN

EDANA +310 member companies supply products and services ranging from raw materials to finished products and everything in between, including machinery, special ingredients, development and testing facilities. Materials often used with nonwovens, such as films and superabsorbent polymers are also represented.




SUPD

TOP 10 ITEMS FOUND ON BEACHES

SINGLE USE PLASTICS DIRECTIVE (SUPD)

EPR (not femcare)

- Costs of the awareness raising measures
- Costs to clean up litter

Awareness raising measures by EU Member States

WHAT IS A PLASTIC?

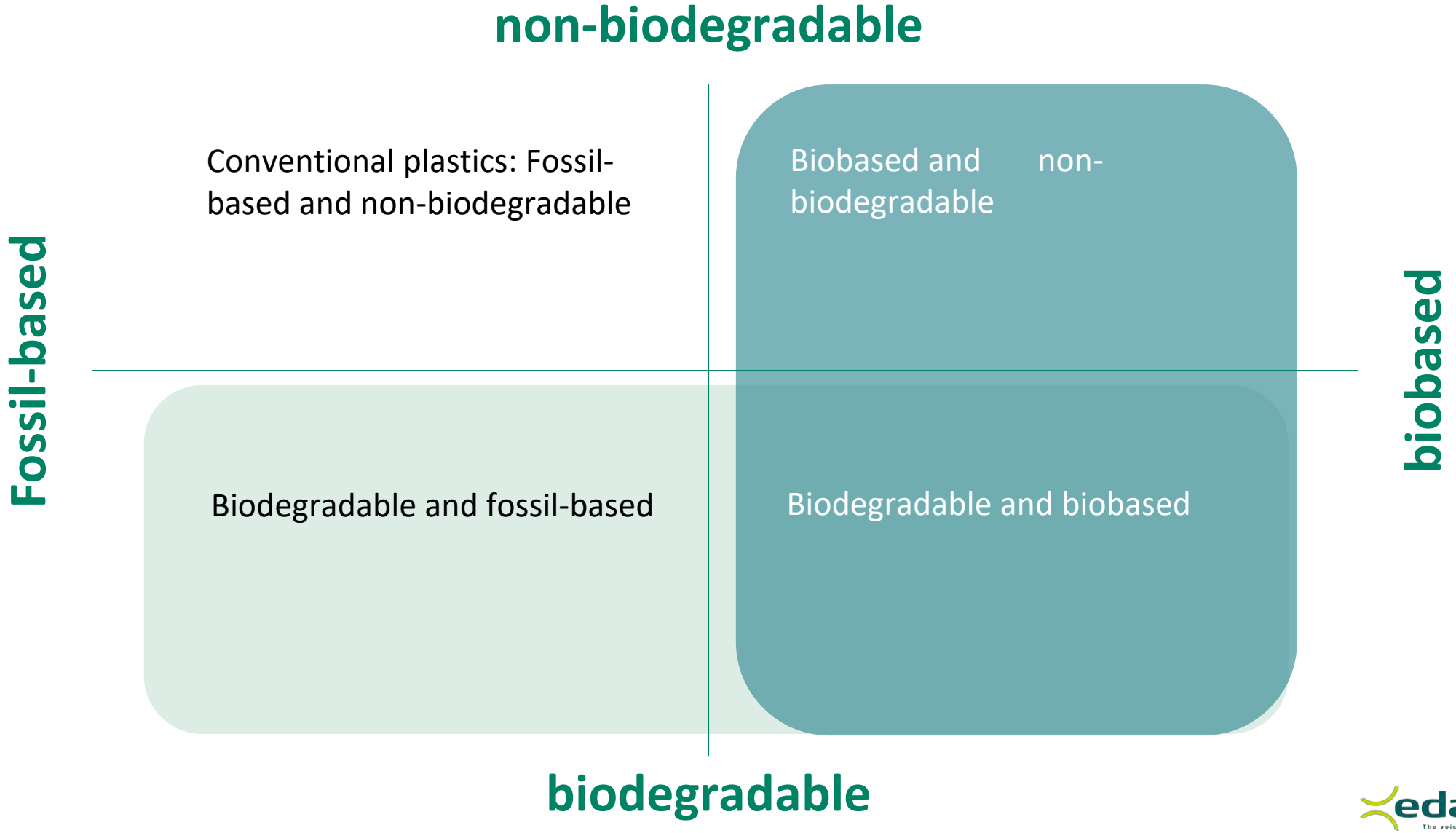
means a material consisting of a polymer as defined in [REACH] to which additives or other substances may have been added, and which can function as a main structural component of final products, ***with the exception of natural polymers that have not been chemically modified***

The SUPD includes all biobased and biodegradable plastics

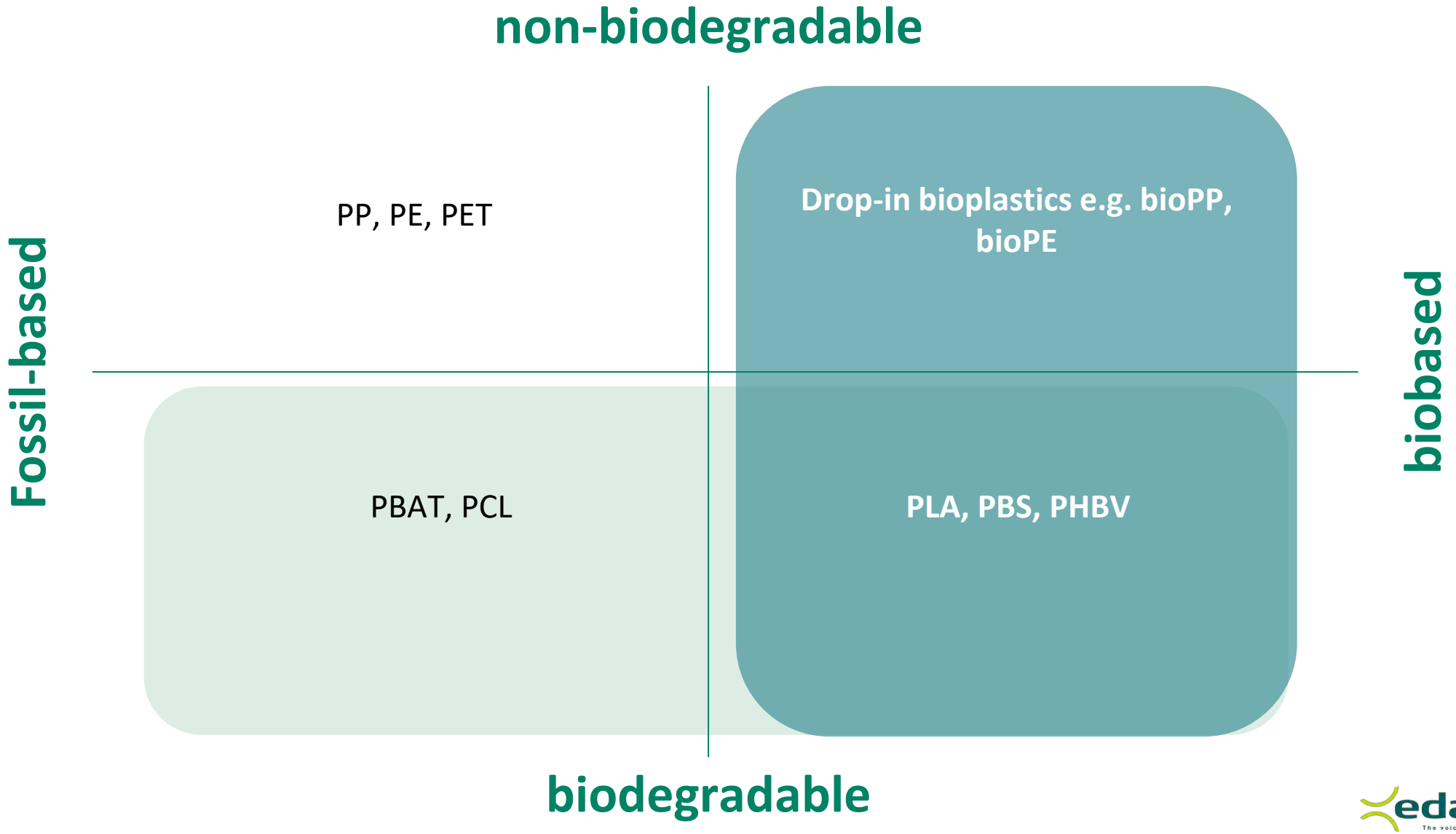
The SUPD bans oxo-degradable plastics

BIOPLASTICS

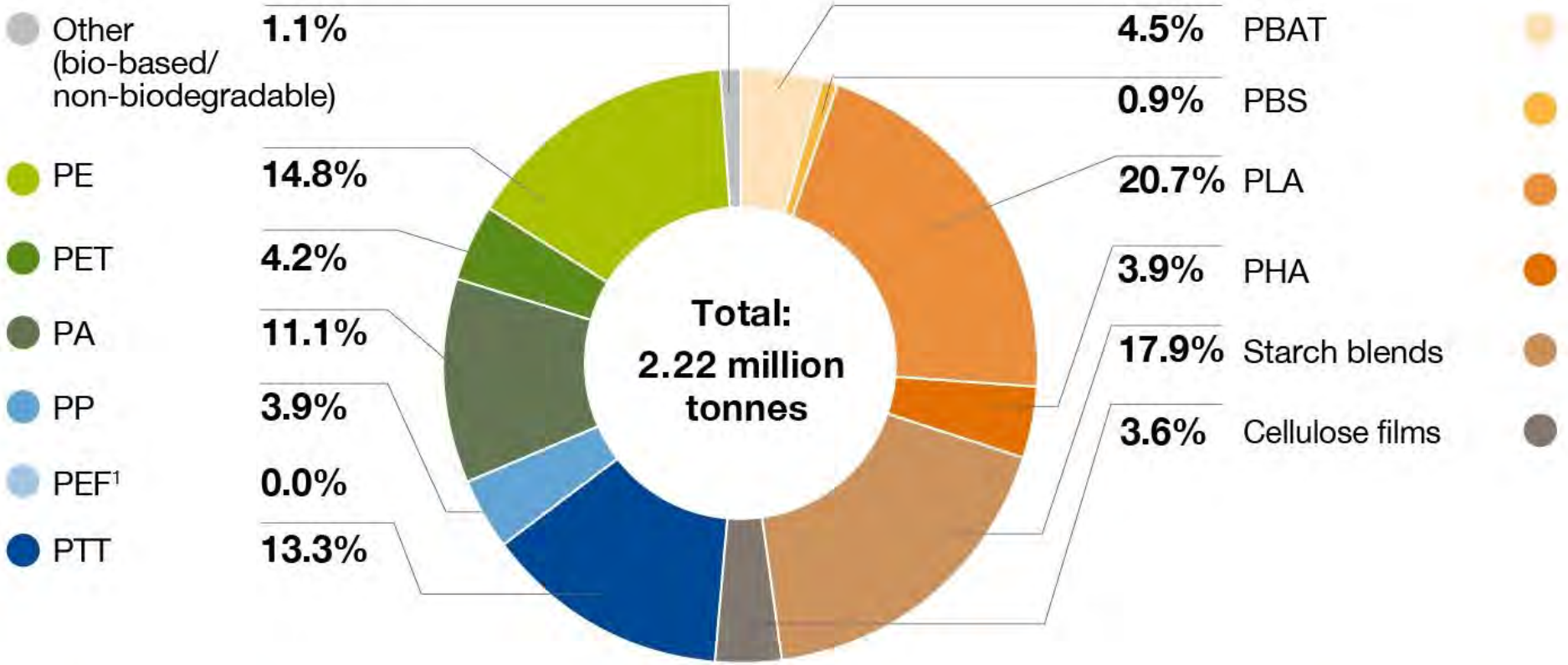
WHAT ARE BIOPLASTICS?



WHAT ARE BIOPLASTICS?

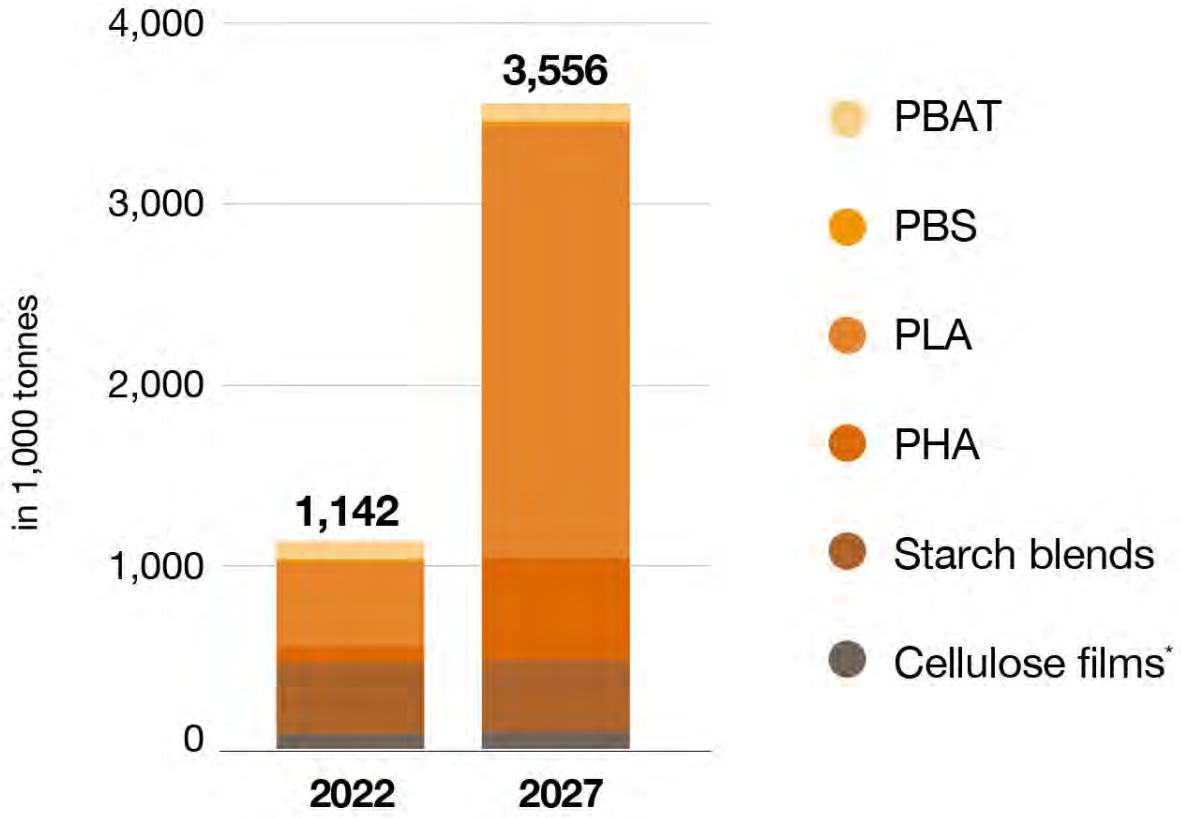


Global production capacities of bioplastics 2022
(by material type)



Source: European Bioplastics, nova-Institute (2022). More information: **www.european-bioplastics.org/market** and **www.bio-based.eu/markets**

Biodegradable bioplastics 2022 vs. 2027



0,003% of total plastic production worldwide 390.7 Mt

*Regenerated cellulose films

Source: European Bioplastics, nova-Institute (2022).
More information: **www.european-bioplastics.org/market** and **www.bio-based.eu/markets**

BIOPLASTIC FRAMEWORK

EU policy framework on biobased, biodegradable and compostable plastics

Limit the use of biodegradable plastics in the open environment **only to specific applications for which reduction, reuse or recycling are not feasible.**

Such plastics should **not** be considered **as a solution** for inappropriate waste management or littering.

Coherent and **science-based testing** and certification standards should be developed

BIOPLASTIC FRAMEWORK

EU policy framework on biobased, biodegradable and compostable plastics

Additives used to manufacture biodegradable or compostable plastics should **biodegrade safely** and not be harmful for the environment.

Plastics labelled as ‘biodegradable’ must always specify the receiving open environment for which they are intended and the **required timeframe** for their biodegradation, in terms of weeks, months or years.

BIOPLASTIC FRAMEWORK

EU policy framework on biobased, biodegradable and compostable plastics

Industrially compostable plastics should only be used for specific applications when the environmental benefits are higher than their alternatives and when they do not have a negative impact on the quality of the compost;

Examples: fruit and vegetable stickers, tea bags and filter coffee pods, as well as very light plastic carrier bags although alternatives with no packaging or reusable alternatives are to be preferred

Among the range of potential non-packaging applications for compostable plastics, absorbent hygienic products merit particular attention.

PACKAGING AND PACKAGING WASTE DIRECTIVE

Compostable and prescribes that filter coffee pods, sticky labels attached to fruit and vegetables and very lightweight plastic carrier bags shall be compostable by 24 months after the entry into force of this Regulation.

MICROPLASTIC RESTRICTION

Intentionally added microplastics

Exemptions for:

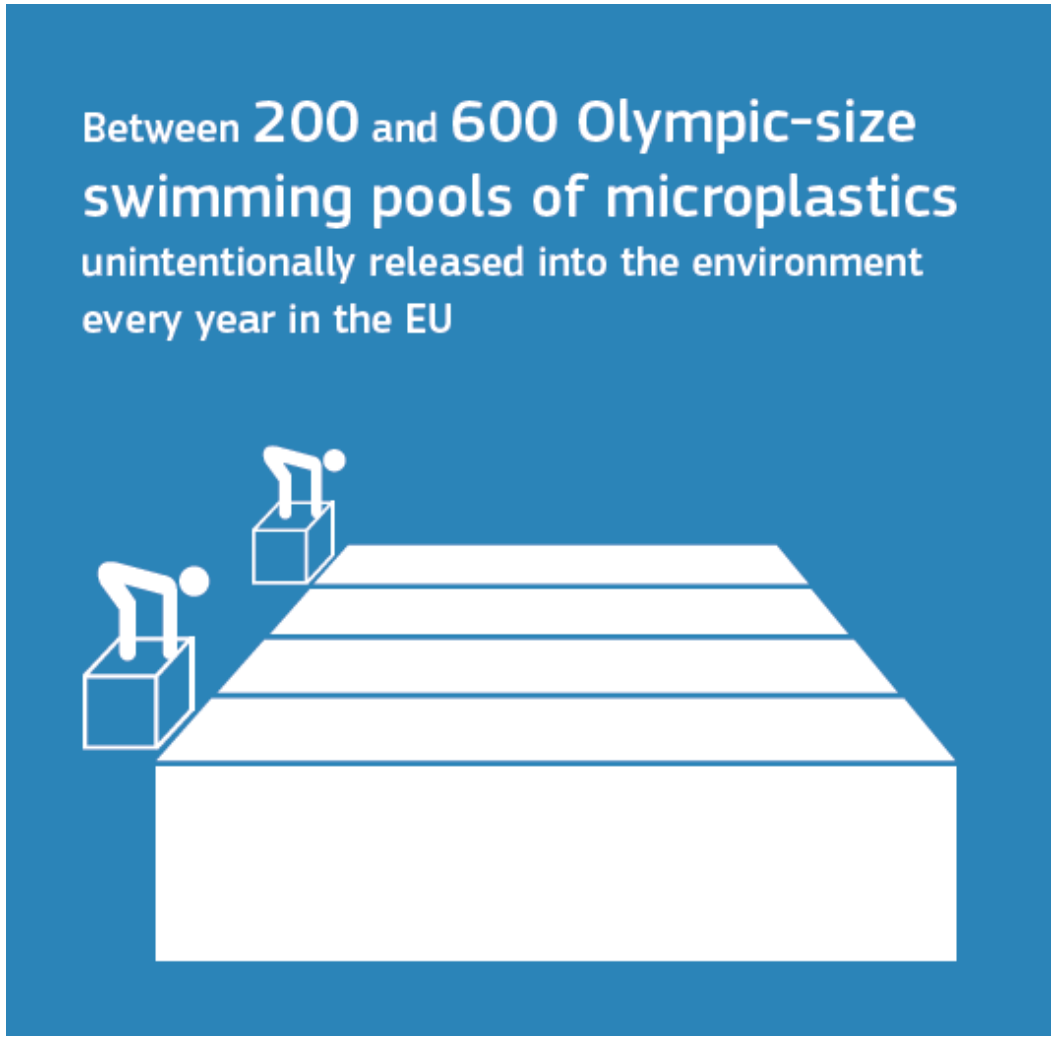
a) Non chemically modified natural polymers

b) **Biodegradable polymers**

c) Polymers with solubility > 2 g/L

d) Polymers that do not contain carbon atoms in their chemical structure

UNINTENTIONAL RELEASE OF MICROPLASTICS



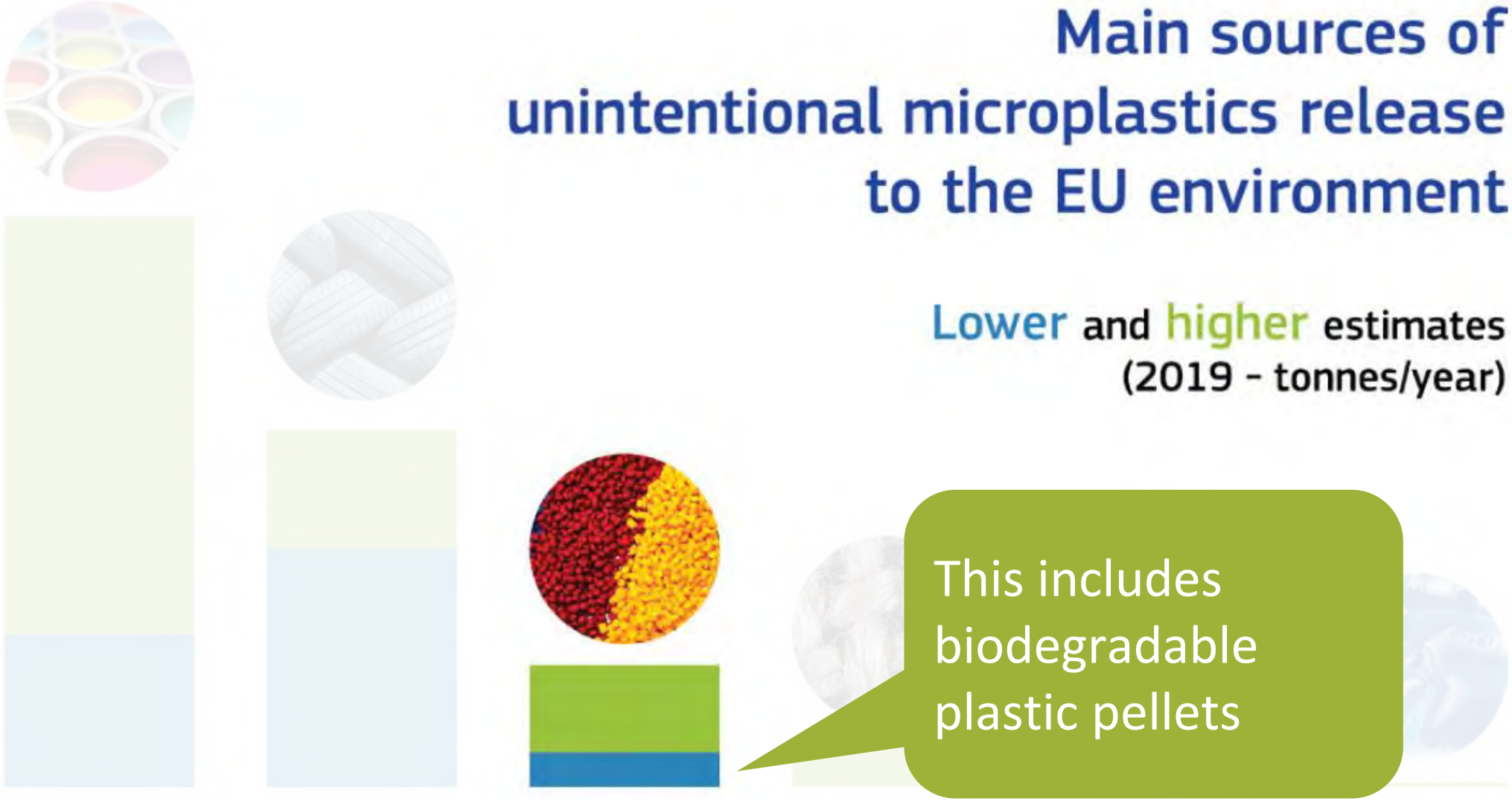
Main sources of unintentional microplastics release to the EU environment

Lower and higher estimates
(2019 - tonnes/year)

Paints	Tyres	Pellets	Textiles	Geotextiles	Detergent capsules
863 000 - 231 000	540 000 - 360 000	184 290 - 52 140	61 078 - 1 649	19 750 - 6 000	5 980 - 4 140

Main sources of unintentional microplastics release to the EU environment

Lower and higher estimates
(2019 - tonnes/year)



This includes biodegradable plastic pellets

Unintentional release of microplastics

Not in scope of the current revision, but …

Some geotextile materials are used to keep plants in place while they root.

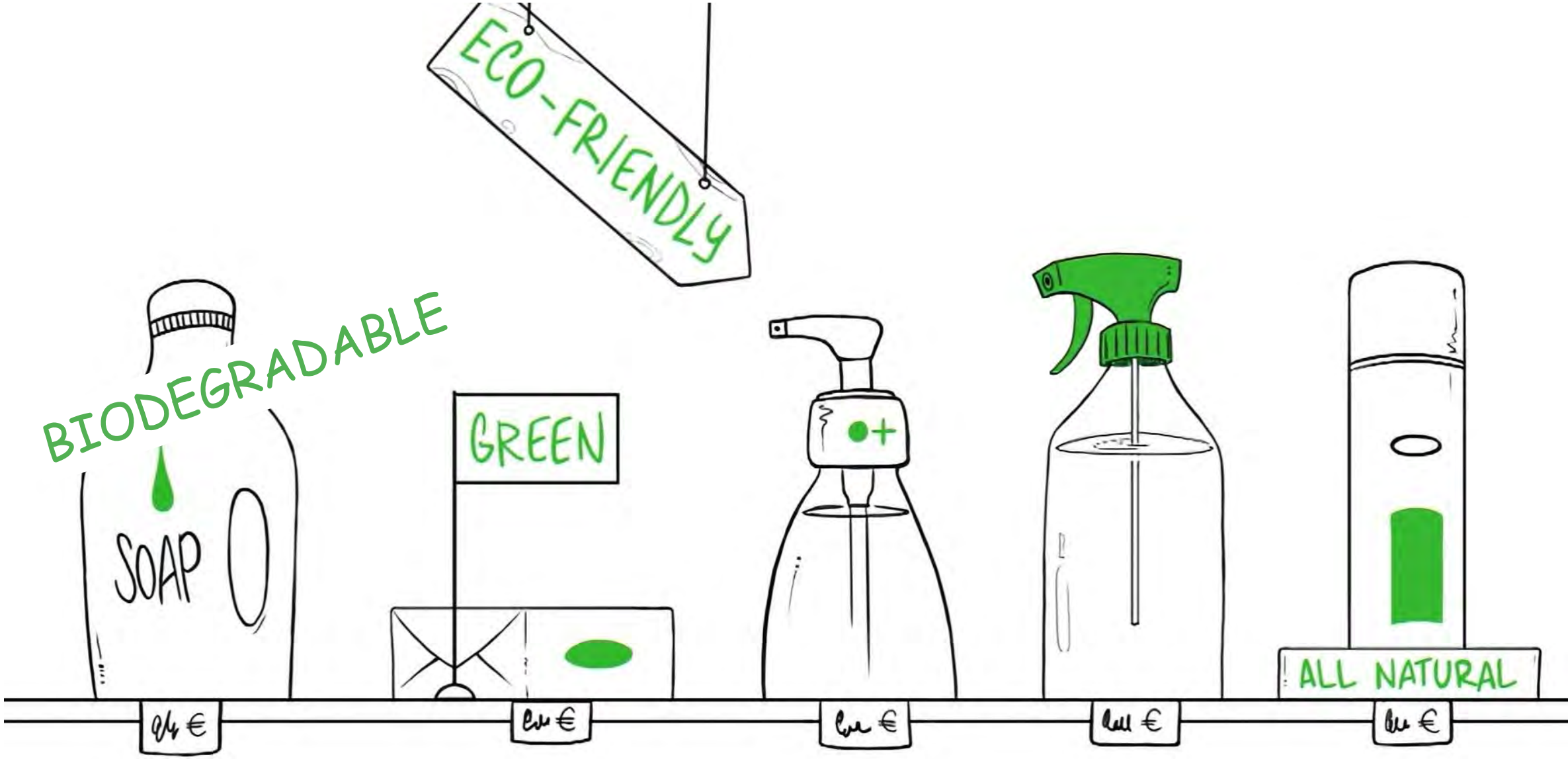
One policy measure could be:
the mandatory use of biodegradable and bio-based materials

GREEN CLAIMS

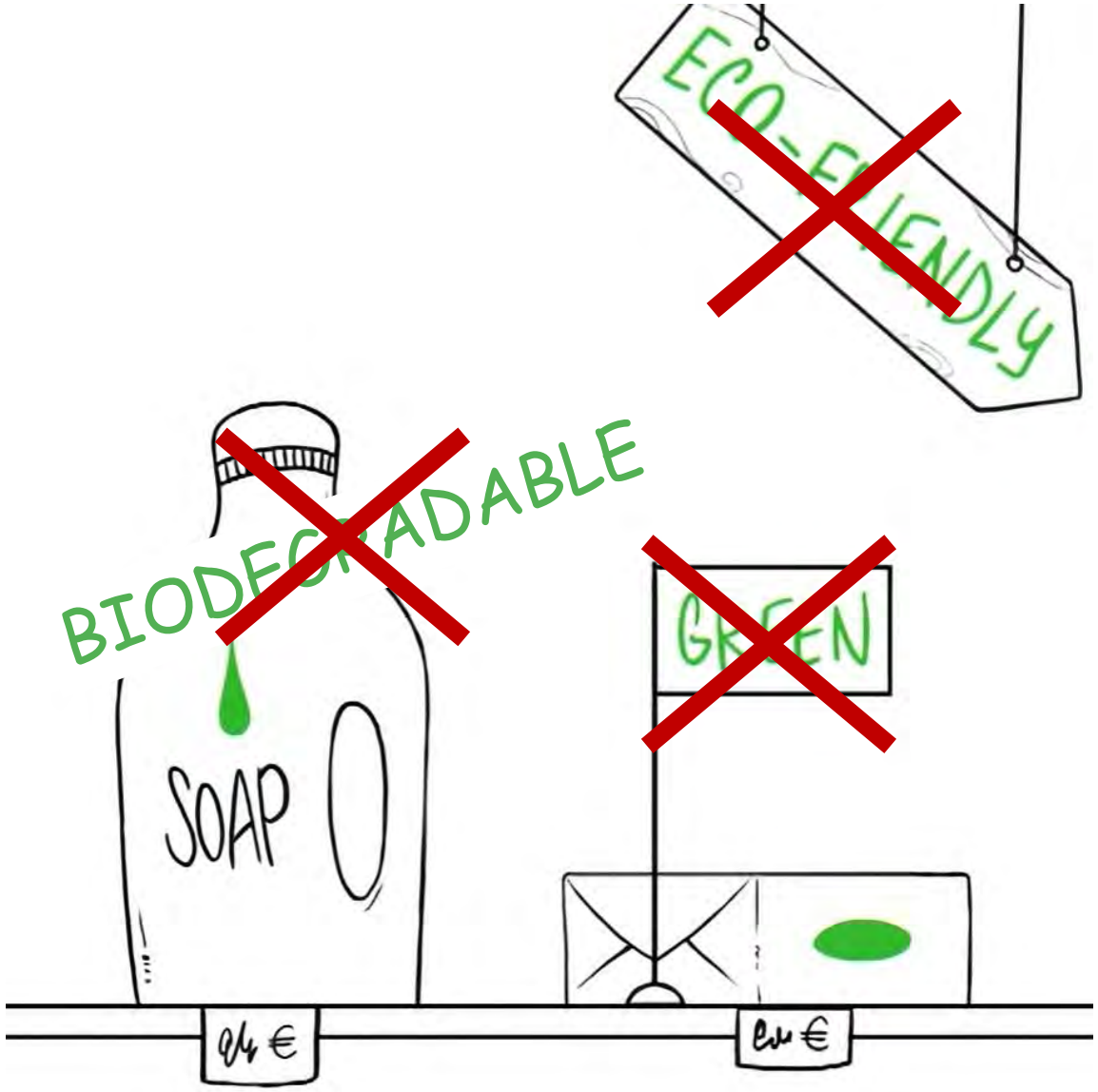
Empowering consumers for the green transition

« MAKE GREEN CLAIMS RELIABLE, COMPARABLE AND VERIFIABLE ACCROSS THE EU, TO PROCTER CONSUMERS FROM GREEN WASHING »

Green Claims directive



How to make green claims



EU institutions are developing different legislations on green claims

Not: biodegradable

But e.g., “the packaging is biodegradable through home composting in one month”

ANFA Conference

Thank You

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General manager, EDANA
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edana
The voice of NONWOVENS

无纺布高增值产品的应用-
水溶性海岛纤维在非织造领域的应用

Application of water-soluble island fibers in the field of nonwovens

宁波恒其德化纤科技有限公司

目录/CONTENT

一、水溶性海岛纤维

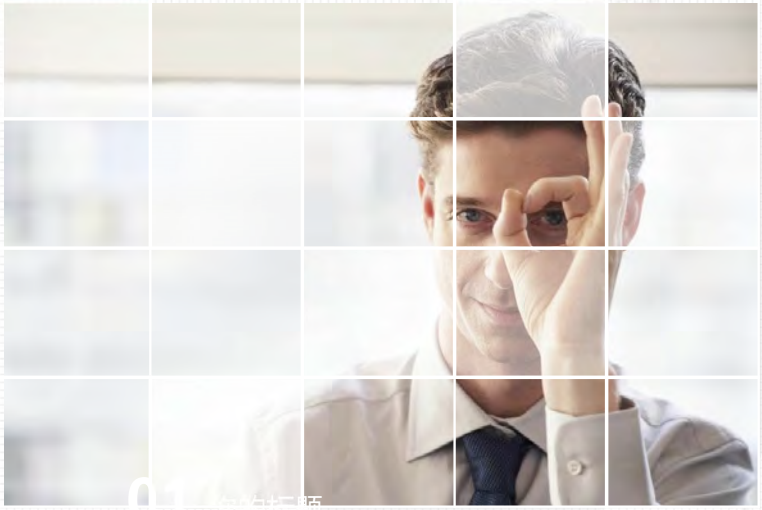
二、水溶性海岛纤维和传统海岛纤维的区别

三、水溶性海岛纤维在超纤皮革领域的应用

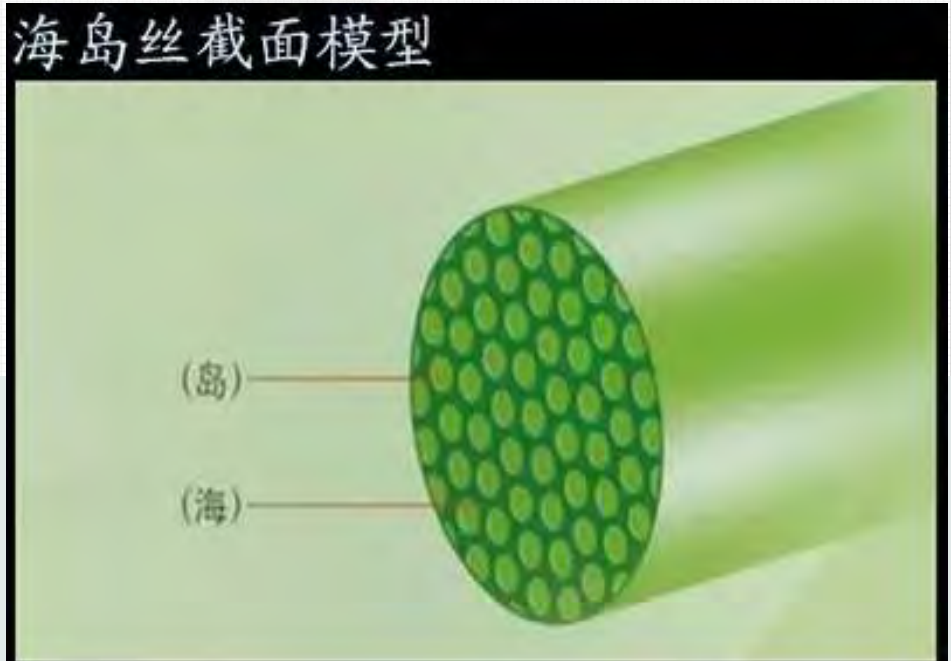
四、水溶性海岛纤维的发展前景

海岛纤维

Island fiber



海岛纤维是将一种聚合物分散于另一种聚合物中，在纤维截面中分散相呈“岛”状态，而母体则相当于“海”。



20世纪70年代初，日本发明了不定岛海岛纤维和定岛海岛纤维。

水减量海岛纤维

Water dissolution

水减量海岛纤维顾名思义就是可以用水减量的海岛纤维。水减量海岛纤维的海相树脂是聚乙烯醇（PVA），由于PVA具有易溶于水的特性，因此水减量海岛纤维不需要任何化学溶剂只需要热水就可以完成减量。

新型海岛纤维和传统的海岛纤维区别

The difference between water-soluble island fibers and traditional island fibers

水减量海岛纤维

Water dissolution

减量溶剂是水（H_2O），无毒无腐蚀。

碱减量海岛纤维

NaOHdissolve

减量溶剂是氢氧化钠（NaOH）溶液，强腐蚀。

苯减量海岛纤维

Toluene dissolution

减量溶剂是热甲苯（C_7H_8），剧毒易燃易爆。

苯减量不定岛海岛纤维

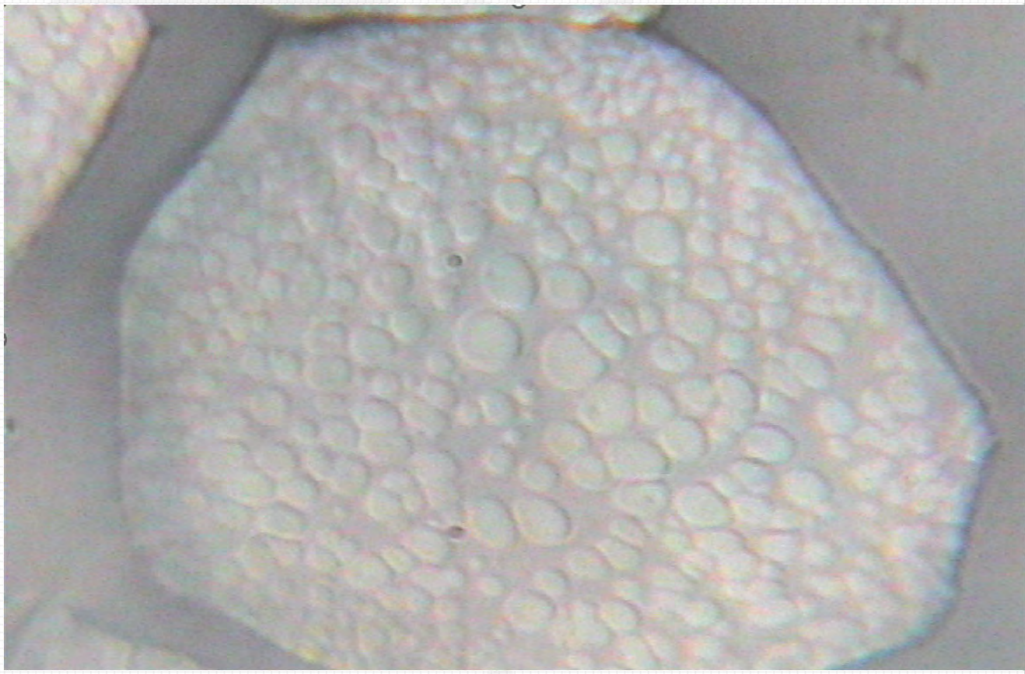
Benzene reduction indefinite island fiber

1 岛相树脂在海相树脂中呈粗细不等。

2 限制了岛相的品种。

3 染色时很难着色。

4 减量溶剂有毒、易燃易爆。



碱减量定岛海岛纤维

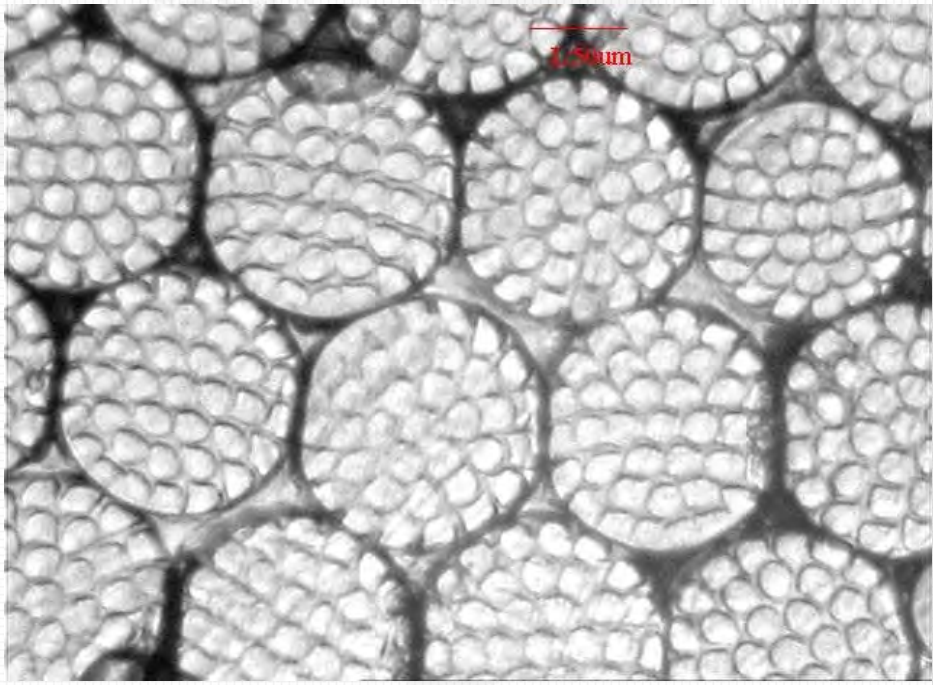
Alkali reducing island fiber

1 岛相树脂中呈粗细均匀，分布均匀。

2 可以生产多种树脂岛相的品种。

3 岛的纤度在**0.03-0.1dtex**，染色牢度好，色泽鲜艳。

4 溶出的对苯二甲酸被列入危险固废，需要运送到有处理资质的企业做有偿处理。



水减量定岛海岛纤维 Water reduction island fiber

1

具备苯减量和碱减量海岛纤维的优良特性，并覆盖了苯减量和碱减量海岛纤维的所有应用领域 。

2

解决了传统海岛纤减量溶剂对人体伤害和环境污染问题。

3

扩宽了新的应用领域可以和多种聚合物通过复合纺丝生产橘瓣纤维、夹心纤维、皮芯纤维。

4

溶出的PVA可以回收作为副产品销售，变废为宝。

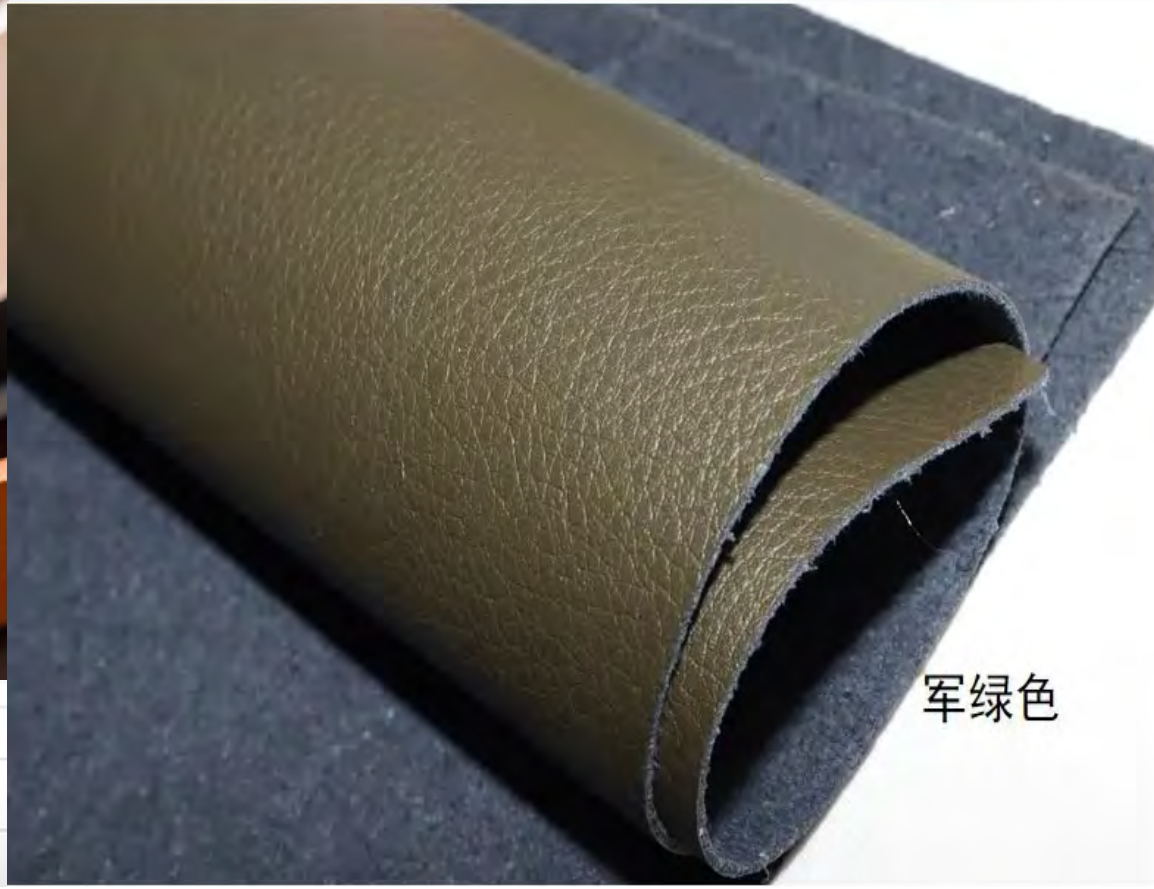
水溶性海岛纤维在汽车内饰领域的应用

Application of water-soluble island fibers in the field of nonwovens

水溶性海岛纤维在鞋类制品应用

水溶性海岛纤维在体育用品应用

水溶性海岛纤维在牛纤皮的应用



水溶性海岛纤维在家具家装的应用

水溶性海岛纤维在家纺服装的应用

水溶性海岛纤维的发展前景

未来 宁波恒其德将沿着可持续发展的方向，研发更多低碳环保、可降解的新产品。

2023年 宁波 恒其德建设年产7.6万吨水减量定岛海岛纤维生产基地。

2019年 中国成功研发出水减量定岛海岛纤维。

20世纪70年代初 日本可乐丽公司和日本东丽公司发明了苯减量不定岛海岛纤维和碱减量定岛海岛纤维

水溶性定岛海岛纤维是国内首创自主研发、具有国际最前沿技术的项目。

产品已通过行业专家和质量监督部门鉴定，各项指标完全达标；已被轻工联合会推荐到国家发改委，列为合成革行业《十四五》重点项目。该项目已经获得国家专利局授权的8项发明专利和三项实用新型专利。

谢谢您！

Thank you!

汇报人　尹德河

Nonwovens Market Trends after the COVID-19 Pandemic-

Nonwovens Moves to a Sustainable Future

ANFA 2023

Mark Snider, Chief Market and Industry Analyst

Association of the Nonwoven Fabrics Industry

ADVANCING ENGINEERED MATERIAL SOLUTIONS

INDEX 23 Results

INDA interviewed over 100 companies at the INDEX show in Geneva, April 2023 and every one of them mentioned sustainable initiatives as their #1 Objective going forward. Since then, the World of Wipes and Filtexpo mirrored the desire to move to a more sustainable future.

What is SUSTAINABLE?

Overused and misunderstood but useful

Trying to achieve a lower carbon footprint is the goal…while this objective is not completely sustainable it is a step in the right direction.

Primary Goals – Try to reduce the carbon footprint

and be globally conscious and aware of consequences.

A product does not have to be 100% sustainable to have a significant affect on sustainable goals.

Market Trends

Several Trends have come forward in 2023

- Government push to develop sustainable goals and new supporting legislature for sustainable initiatives.

- A push to use non-manmade raw materials.

- Improve production efficiency.

- Utilize non-fossil fuels.

- Focus on both disposable and durable markets equally.

To Discover New and Innovative ways to Recycle

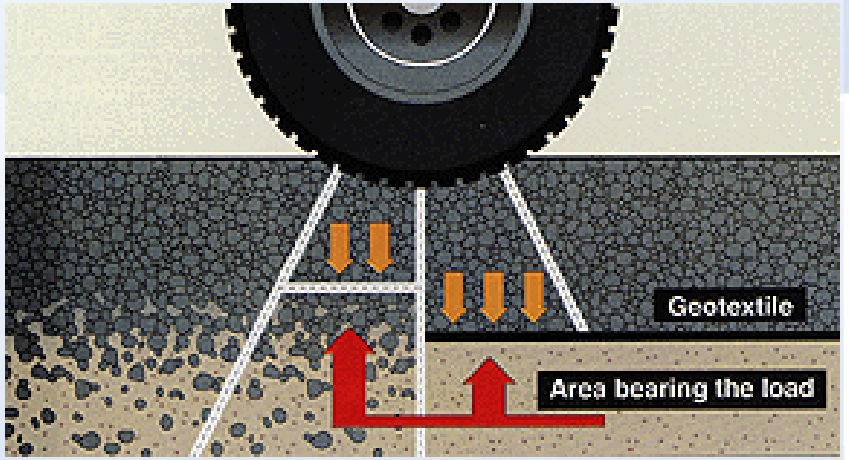
Specific Trends / Geotextiles

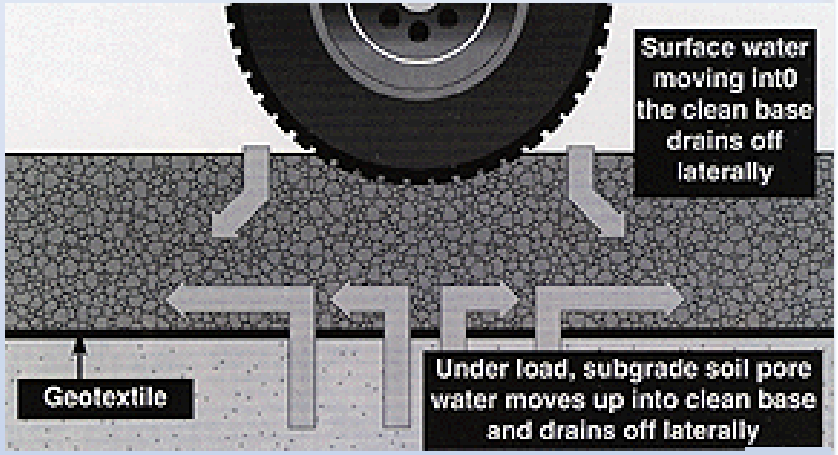
- New requirements for roads and engineered composites.

Increases road life by 30 to 50%

Reduces the amount of aggregate, asphalt and or concrete.

Although these materials aren't recycled, they contribute considerable sustainable value.





Specific Trends / Agrotextiles

- Promote re-use of crop cover substrates.

Improved material development to meet new performance requirements for strength, absorbency and UV stabilization.

Specific Trends / Wipes

- A push to natural fibers.

- Stricter flushability standards

- Natural packaging

- Legislation to ban certain non-sustainable products.

- Some government legislation is in the process of banning ANY wipe with plastic in it!

Specific Trends / Automotive

- A push for lighter substrates/Electric Cars

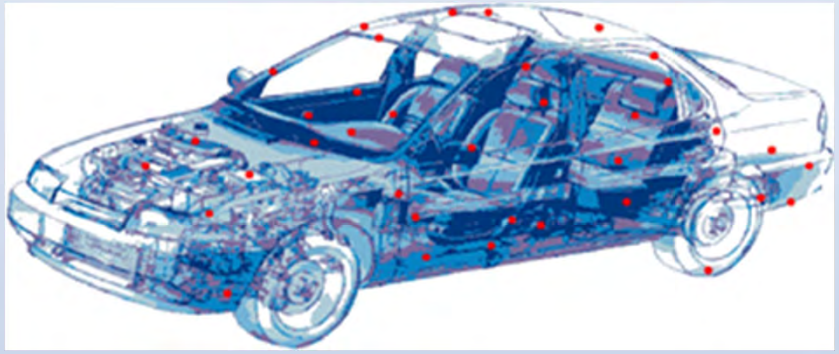
- Improved acoustic performance.

- Longer lasting batteries/Laminar technology

- More durable and heat resistant.

- Over 40 automotive applications for nonwovens.

- As with Geotextiles; Although these materials aren't recycled, they contribute considerable sustainable value.



Specific Trends / Filtration

- A push for higher performance substrates with lower air resistance.

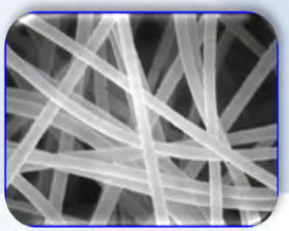
- Improved filtration efficiency.

- Lower carbon footprint.

- More durable and heat resistant.

- As with Geotextiles and Automotive; Although these materials aren't recycled, they contribute considerable sustainable value.

Nonwovens, Technology Innovations
Its All About Science and Engineering…



Process Control:

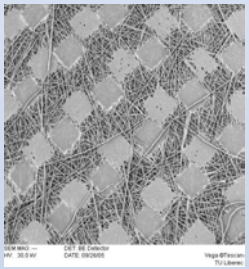
- Temperature Control
- Air flow
- Polymer flow
- Speed

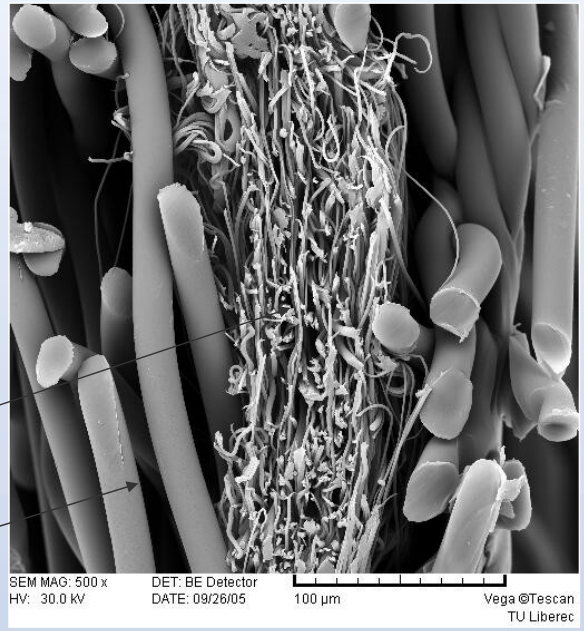
Testing and Performance

- Specifications
- Accuracy
- Handling and Storage
- Construction

The sample at right represents a composite media of spunbond / Meltblown / Spunbond (SMS)

Fine meltblown fibers improve filtration efficiency and overall filter performance.





SOME CURRENT STATISTICS

Nonwovens

A successful, growing, continuously evolving, dynamic, and extremely diverse industry

Absorbent Hygiene	Vehicle Construction
Filtration (Air and Liquid)	Building Construction
Wipes	Home & Office Furnishings
Medical/Surgical	Geosynthetics
Disposable PPE	Apparel (Durable PPE)
Other Disposable	Other Durable

262 Categories

A $19.2B Industry in North America

US Nonwoven Growth Typically Exceeds GDP Growth by 75% +

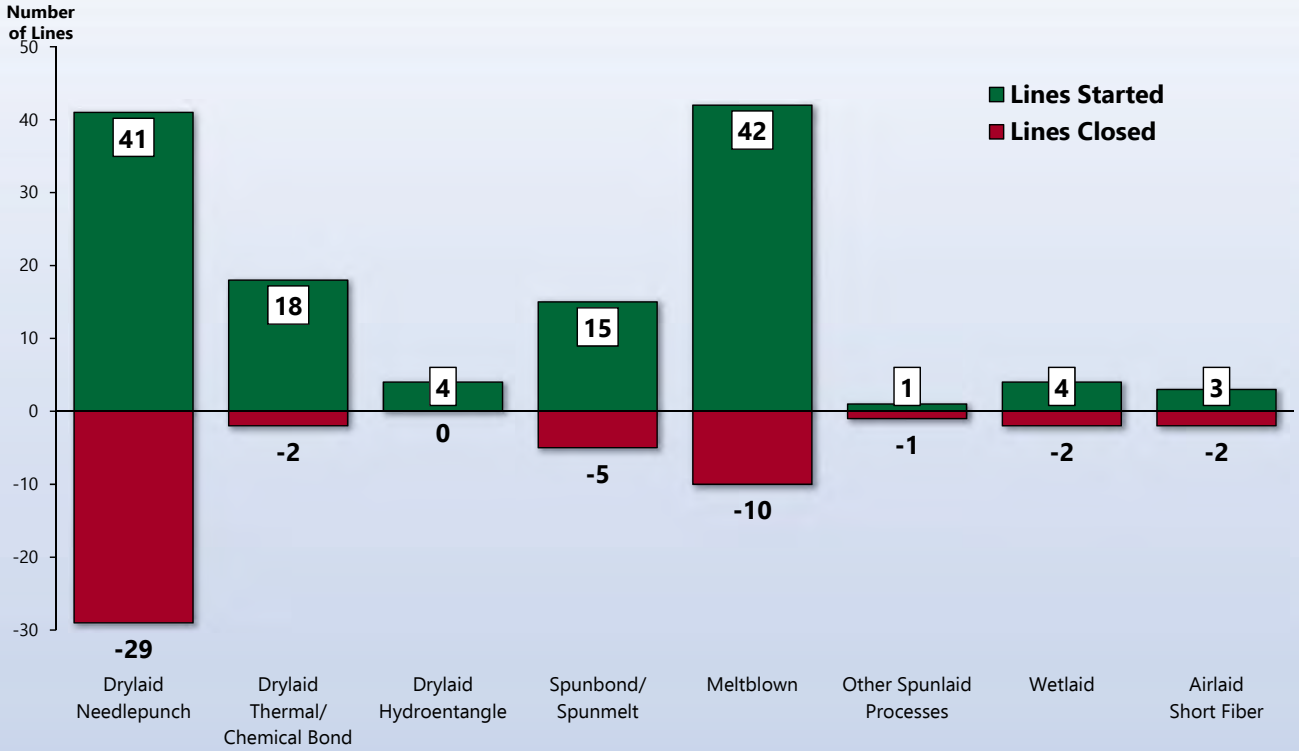
2023 Nonwoven Material at the Producer Level

Supply-Side Trends for 2023

- **Investments**
  - Increased Capacity Growth for Staple and Stitch Bond Processes
  - Government re-evaluation of tariffs
  - Slight Shift down for Resin-Based Processes
- **Sustainability**
  - Increased Usage of Natural Fibers and improved sustainable initiatives
  - Focus on Bio-Based Materials (Biopolymers, Bio-Based SAP and PET)
  - New processes for bio-degradable substrates
  - Plastic Recycling (Mechanical AND Molecular)
- **Technology Innovation**
  - Functionalizing Nonwoven Material
  - Nanotechnology / Fine Fibers / Meltblown
  - Machinery and polymer development

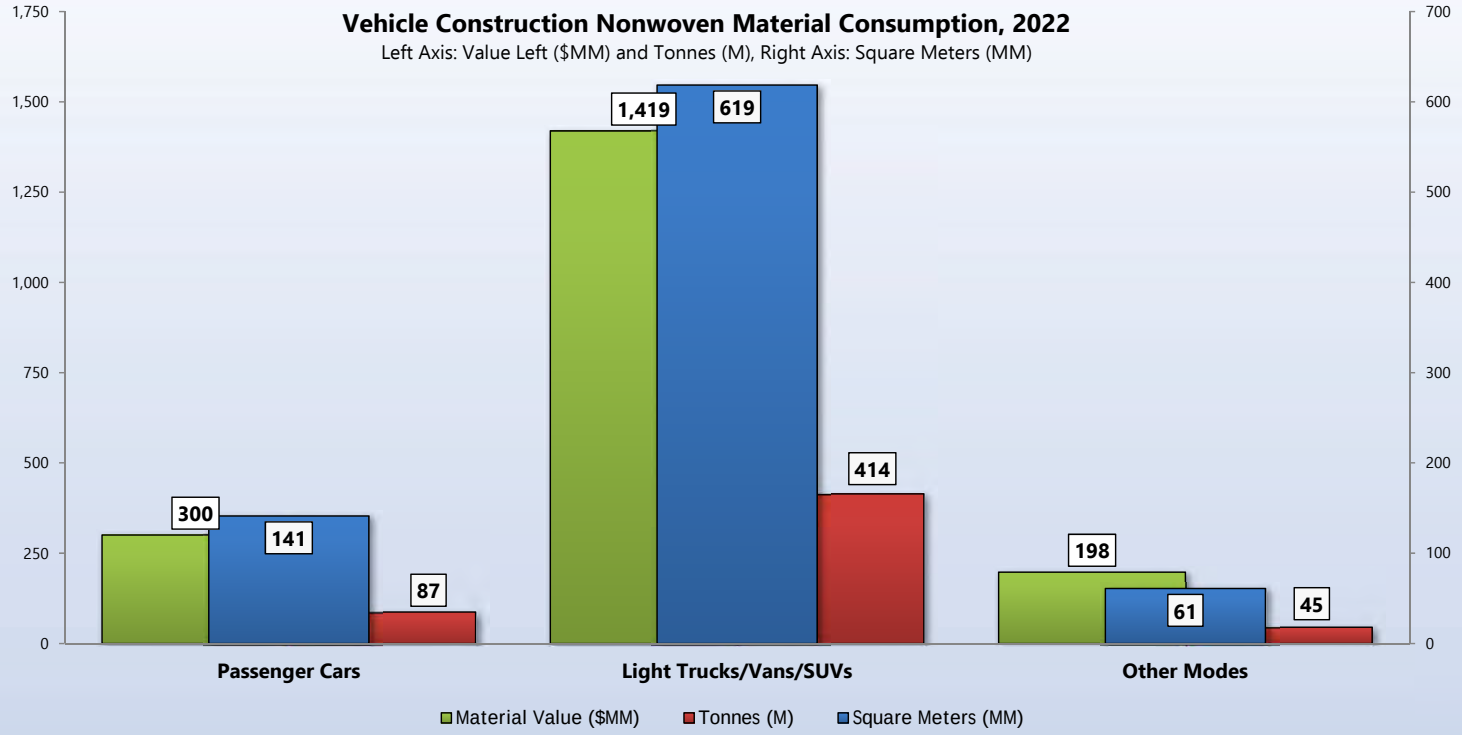
Lines Start…and Lines Close

North America Capacity Changes
(by Line Type, 2017–2022)



Source: INDA North American Nonwovens Supply Report 2021, May 2022

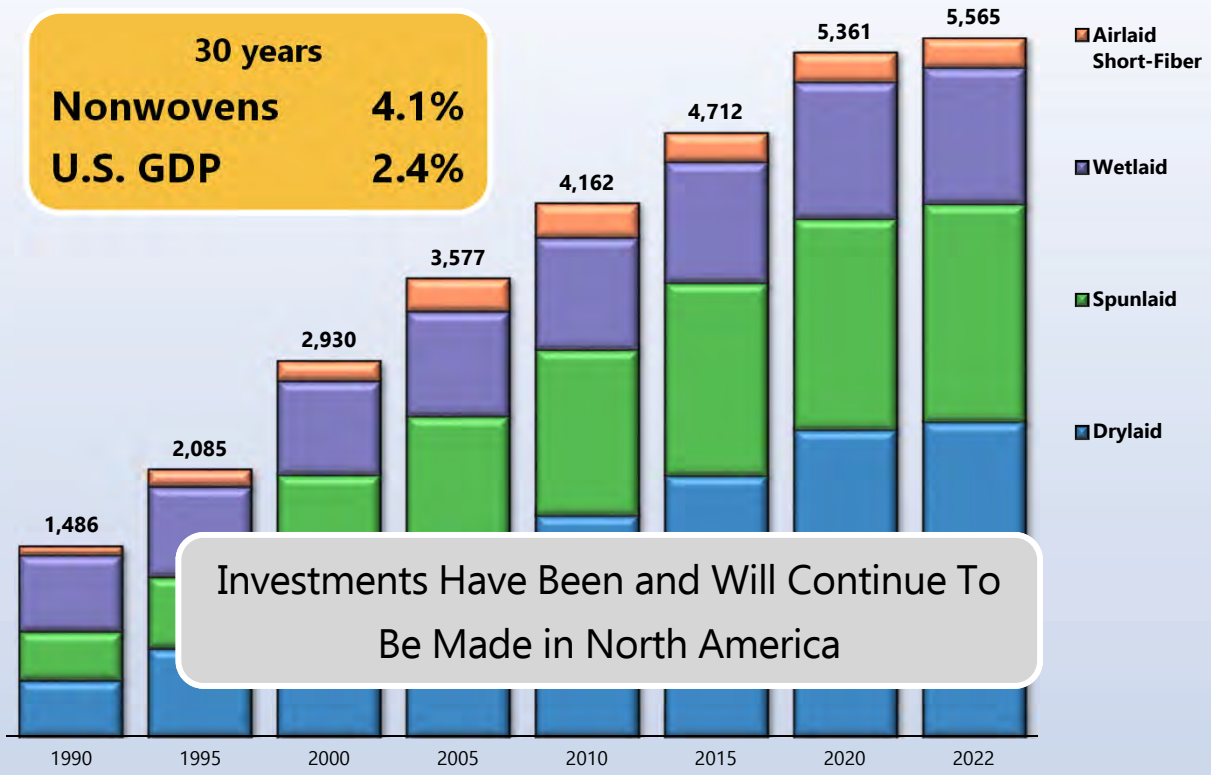
Automotive



Source: INDA Estimates, 2023

North America Investments Exceed GDP

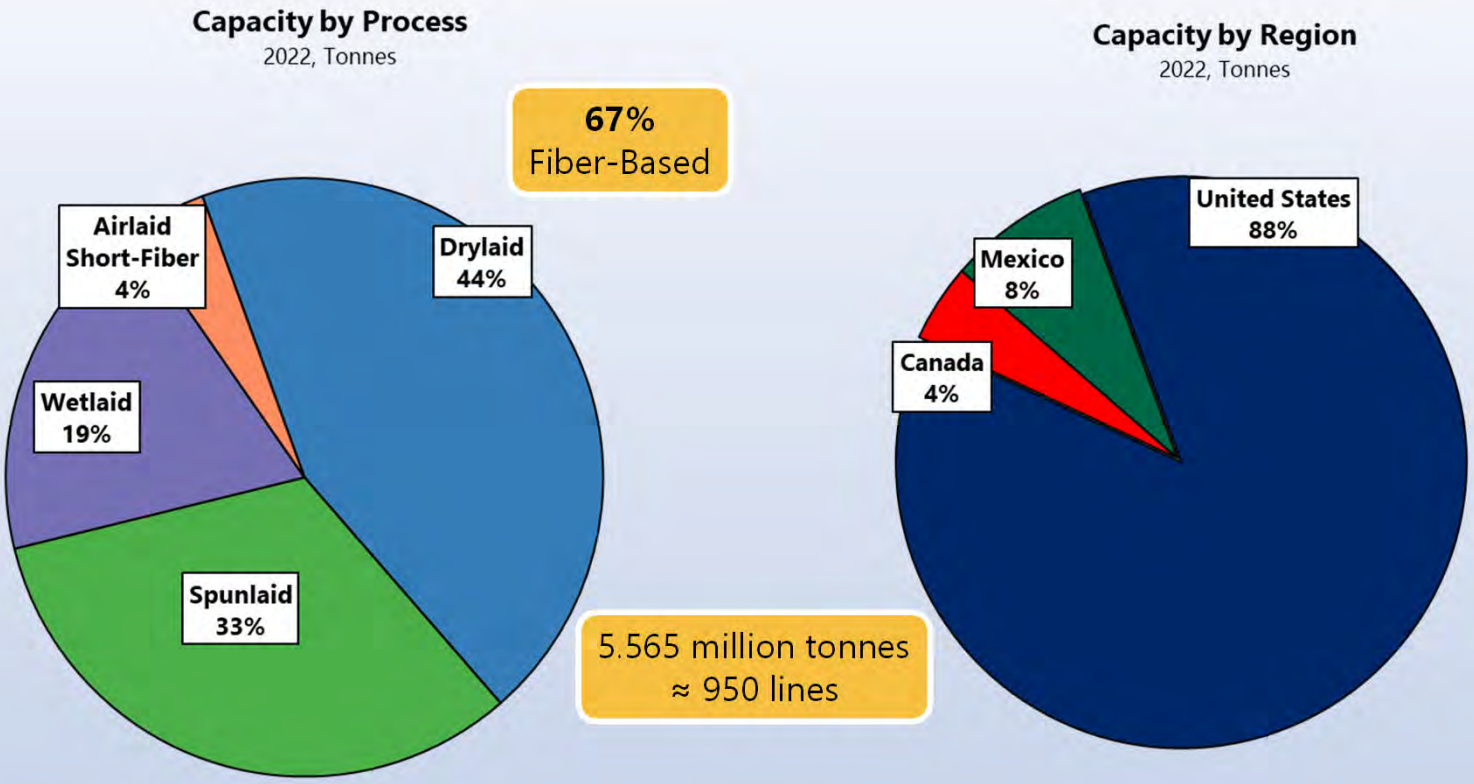
North America Capacity by Process, 1990 to 2022, in Thousands of Tonnes



Source: INDA North American Nonwoven Materials Annual Study 2022

North American Capacity End of 2022

North America Capacity in Tonnes, 2022

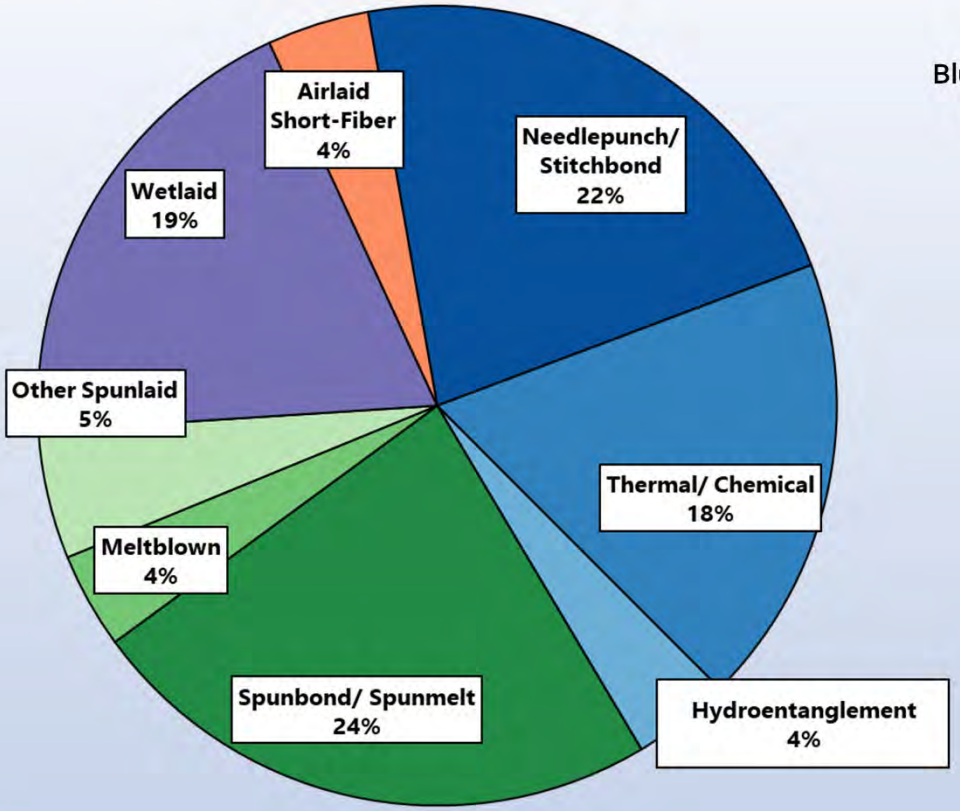


Variety of Processes & Attributes

North America Capacity by Detailed Process, 2022

Green Shades Represent Spunlaid Processes

Blue Shades Represent Drylaid Processes

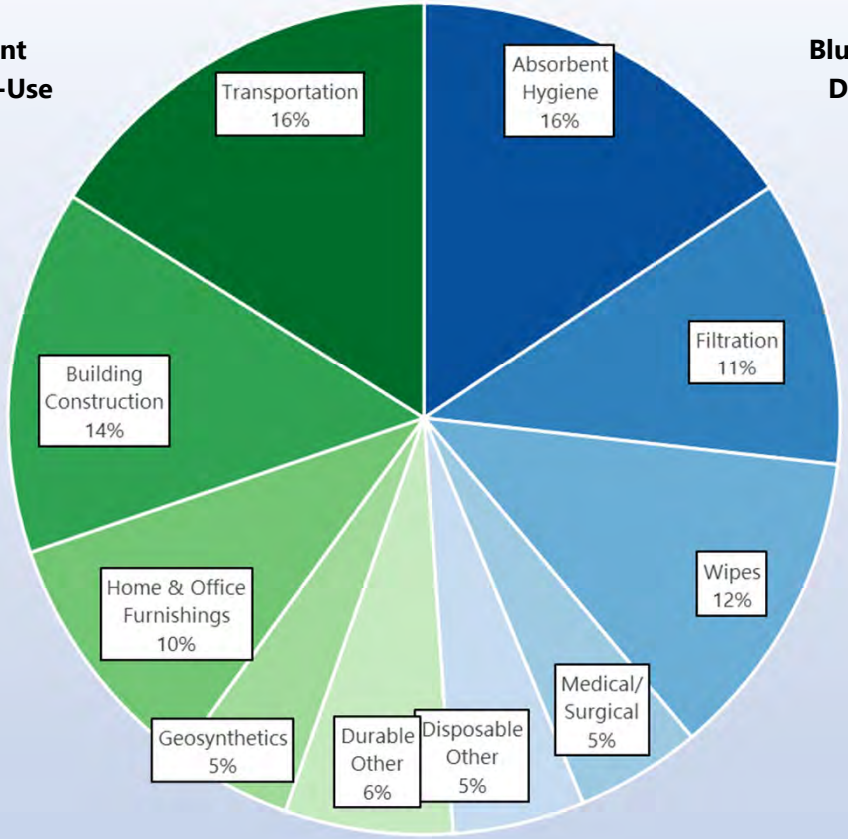


Source: INDA, 2023

Variety of End-Uses

North America Production by End Use in Tonnes, 2022

Green Shades Represent Long-Life / Durable End-Use Markets 51%



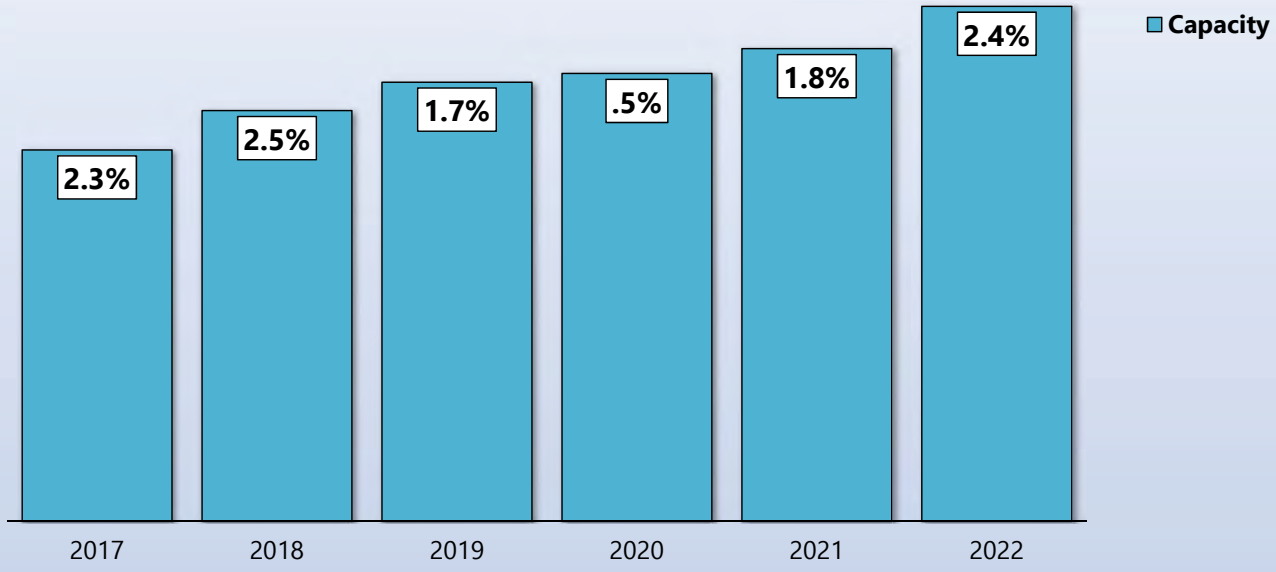
Blue Shades Represent Disposable End-Use Markets 49%

Source: INDA, 2023

Significant Increase in Investment

North American Capacity, Tonnes, 2017–2023 with AAGR

2023
+4.2%
+230,000t



INDA'S VISION FOR THE FUTURE

INDA's Vision for the Future

INDA will continue to support the Global Nonwovens Industry by:

- Providing more comprehensive and timely reports
  - Washington Alert (Monthly releases 2023)
  - Market Pulse (3 Quarters released this year)
  - NA Annual Study (Supply Report released May 15th 2023)
- Providing more training and webinar support
  - Improved In-house training program for both beginner and intermediate training
  - More frequent and scheduled webinars of industry interest

WE WILL CONTINUE TO GROW THE INDUSTRY

INDA is Changing with the Future

Nonwovens is a Strong Growth Industry

- Incredibly Dynamic and Diverse
- Engineered Material Solutions are Always on the Forefront
  - Innovation is Driving Growth
  - Technology is Driving Growth
  - Sustainability is driving Growth
- Attractive for Capital Investments
- **Nonwovens Protects and Improves Lives**

INDA's Vision / Our Events

Adjust events to reflect our Industry wants/needs

- INDA has listened to it's members
  - We have relocated some future events to make them less costly to exhibitors
  - Lower venue costs
  - Lower hotel costs at exhibit cities
  - More accessible to airports and local transportation
  - Lower food costs

WOW WORLD OF WIPES

RISE

FiltXPO

Hygienix

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Association of the Nonwoven Fabrics Industry
ADVANCING ENGINEERED MATERIAL SOLUTIONS

无纺布制造企业的营销新思维与推广模式-空气过滤材料的市场、挑战和机遇

Market, Challenges and Opportunities on Air Filtration Materials

TECHNOLOGY ZISUN 再升科技

重庆再升科技股份有限公司

干净空气．高效节能市场趋势

（一）、行业情况综述

我国《第十四个五年规划和 5368#年远景目标纲要》提出推动绿色发展，促进人与自然和谐共生，强调深入开展污染防治行动，持续改善环境质量，加快发展方式绿色转型，全面提高资源利用效率，大力发展绿色经济，构建绿色发展政策体系，制定 5363#年前碳排放达峰行动方案，努力争取 5393#年前实现碳中和，推动经济社会发展全面绿色转型，建设美丽中国。

党中央、国务院印发的《中共中央国务院关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见》明确指出：

加快形成绿色生产生活方式。大力推动节能减排，全面推进清洁生产，加快发展循环经济，加强资源综合利用，不断提升绿色低碳发展水平；

大力发展绿色低碳产业。加快发展新一代信息技术、生物技术、新能源、新材料、高端装备、新能源汽车、绿色环保以及航空航天、海洋装备等战略性新兴产业；

大力发展节能低碳建筑。持续提高新建建筑节能标准，加快推进超低能耗、近零能耗、低碳建筑规模化发展。大力推进城镇既有建筑和市政基础设施节能改造，提升建筑节能低碳水平。

《中共中央关于制定国民经济和社会发展第十四个五年规划和二〇三五年远景目标的建议》，将“民生福祉达到新水平”作为“十四五”时期我国经济社会发展的主要目标之一。实现这一经济社会发展目标，必须坚持以人民为中心的发展思想，进一步解决人民群众最关心最直接最现实的利益问题，推动高质量发展、创造高品质生活，不断实现人民对美好生活的向往。

中共中央、国务院印发了《扩大内需战略规划纲要（2022 - 2035 年）》，纲要指出我国经济由高速增长阶段转向高质量发展阶段实施，通过增加高质量产品和服务供给，满足人民群众需要，促进人的全面发展和社会全面进步，推动供需在更高水平上实现良性循环。

全球对绿色、环保、节能要求的不断提升，高质量发展、高品质生活的多种需求为“干净空气”和“高效节能”领域创造更多的发展机遇。工业与民用、医疗、电子、农牧业、室内空间、军工、航空航天等领域对“干净空气”和“高效节能”产品应用需求将稳步上升。

干净空气领域

先进制造、产业升级将持续拉动干净空气稳健发展

近年来，随着中国先进制造业的快速发展，对干净空气的需求增长加快，且生产环境的洁净要求越来越高，在国产化替代目标驱动下，以半导体为代表的高端新兴制造领域逐渐成为中国经济发展的新增长点，驱动中国经济由粗放式向高质量发展。洁净室工程作为高端制造领域上游不可或缺的重要基础设施，有望迎来发展红利阶段。其中半导体、集成电路、生物医药和军工行业等预计将成为洁净室工程的主要应用领域，推动行业持续向好发展。未来，随着下游行业对洁净室等级要求的提高，对洁净室工程行业提出了更高的要求，市场需求逐渐向节能、空气分子物污染控制、洁净、防微震、纳米尺度等高端技术应用发展。

随着产业结构不断升级，经济结构不断转型和对空气质量要求不断提升，与干净空气相关的食品生产、医疗健康、现代农业和畜牧养殖等领域的应用将更加广泛。以产业升级促进环境升级，不仅能践行高质量绿色发展目标，还能为企业重塑核心竞争力。公司为不同使用场景用户提供专业的定制化产品、解决方案和工程落地，为行业创造出更加有力的增长动力，也为多产业升级提供了更多的可能，助力开启§干净空气©行业的新篇章。

美好生活为§干净空气©需求带来新的发展机遇

随着工业的不断发展，环境污染、水污染、大气污染接踵而至，干净空气成为大家呼吸的痛点，时刻影响着我们的生活。民众对环境污染所带来的隐患表现出前所未有的焦虑和关注，尤其近年来对空气质量安全的关注和认知逐步提升，干净空气产品能为民众提供持续洁净空气、自由呼吸，为民众的健康保驾护航。健康的生活环境，清新的室内空气，能给予现代人以更多的生活内涵，符合大众追求和向往的美好生活。

高效节能领域

在绿色低碳社会，节能降耗是实现绿色生活方式的主要路径之一。推动能源资源高效利用，用更丰富的优质生态产品绿色创新转型的载体，为美好生活充电，为美丽中国赋能，以满足人民日益增长的美好生活的需要。这不仅影响中国绿色经济复苏和高质量发展，还将引领全球经济技术变革的方向以及改善全球气候环境。

随着节能低碳生活与绿色消费的提出，消费者环保理念和健康意识的提高，绿色家电将成为我国发展的重要方向。绿色环保不仅代表着一种健康的社会生活方式，更是一种可持续的经济发展战略，节能将是产业持续发展的核心变量之一。家电厂商对于家电产品的节能环保方面创新不断，不断追求能耗降低，还向减量化、轻型化、便携化等其他的节能创新方向发展。

在二十大S发展绿色低碳产业，倡导绿色消费&这一时代背景下，作为节能减排的重要方式，绿色建筑的重要性进一步提升。从目前的建筑方式来看，装配式．被动房建筑、钢结构以及光伏建筑一体化等细分领域都是绿色建筑中的主要发展方向，为我国绿色建筑提供了弯道超车的机会。

随着城镇化进程不断加快，我国绿色建筑占新建建筑比重会逐渐提升，新型高效建筑保温材料行业将形成一个新的产业群，带来更多的市场机遇。国家不断出台的政策目标对建筑行业提出新的要求，激发出丰富的市场机遇。作为碳排放量占比较高的行业之一，绿色建筑意味着行业内生产方式、技术水平、材料选择、商业模式等均将面临革新，未来更加高效、环保的节能材料产品将拥有更多机会。

“深耕技术产品 服务双碳战略”

‘Developing technological product in service of the dual carbon strategy ‘

实现碳达峰碳中和，也是党中央统筹国内国际两个大局作出的重大战略决策。习近平总书记强调：“实现‘双碳’目标，不是别人让我们做，而是我们自己必须要做。”我国已进入新发展阶段，做好“双碳”工作是推动高质量发展的必然要求，是加强生态文明建设的战略举措，是维护能源安全的重要保障。

Achieving carbon peak and carbon neutrality is also a major strategic decision made by the Central Committee of the Communist Party of China to coordinate both domestic and international situations. Xi Jinping emphasizes: "To achieve the 'dual carbon' goal, we should not wait for it to be done by others, but we must do it ourselves. China has entered a new stage of development, and doing a good job in the "dual carbon" work is an inevitable requirement for promoting high-quality development, a strategic measure to strengthen ecological civilization construction, and an important guarantee for maintaining energy security.

公司围绕“深耕技术产品、服务双碳战略”，研发绿色健康产品，将绿色理念贯穿产品全生命周期，发挥自身核心材料优势，专注主营业务，不断调结构、提高度、扩市场，持续为用户提供“系统、全面、完整、可靠、稳定”的“低碳无尘空间”解决方案与技术产品。

The company focuses on "Developing technological product in service of the dual carbon strategy ", develops green and healthy products, runs the green concept throughout the entire product lifecycle, leverages its core material advantages, focuses on its main business, continuously adjusts its structure, improves its efficiency, expands its market, and continues to provide users with "systematic, comprehensive, complete, reliable, and stable" low-carbon and dust-free space "solutions and technical products.

三大低碳无尘空间

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- 固定空间　Fixed Space
- 移动空间　Mobile Space
- 工业空间　Industrial Space


固定无尘空间
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应用领域
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家居无尘空调
Household Dust-free air Conditioning

公共空间空气系统
Public Space Air System

建筑保温
Exlogolqj#Lqvxodwlrq

冰箱等家电保温
Insulation for Household Appliances such as Refrigerators

固定无尘空间

经济的发展、空气问题的持续出现、大众对美好生活的向往推动了室内空气质量要求的提升。在短期内，对现有空调系统以及空气质量改善设备和服务（如通风设备、空气清洁产品和空气过滤器）的需求不断增加，从长远来看，通过专注于为用户提供增值和高空气质量解决方案的室内空气质量解决方案的需求持续增加。

（4）相关政策

国家卫生健康委员会《室内空气质量标准》编制说明：（4）人们每天大约有;3（以上的时间是在室内度过的，所呼吸的空气主要来自于室内，与室内污染物接触的机会和时间均多于室外；（5）室内污染物的来源和种类日趋增多，造成室内空气污染程度在室外空气污染的基础上更加重了一层；（6）为了节约能源，现代建筑物密闭化程度增加，由于其中央空调换气设施不完善，致使室内污染物不能及时排出室外，造成室内空气质量的恶化。

健康建筑应用指南（Z HOO# #Khdowk|#Exlogolqjv#Dssdfdwlrq#Jxlgh）指出，建筑的空气、水、营养、光线、健康、舒适和精神等影响人类健康和福祉。《健康建筑评价标准 W2DVF#B50349》中，室内 SP 518#日平均浓度不高于 58xj2p 6，SP 43#日平均浓度不高于 25ug/m3，CO2日平均浓度不大于 900ppm。

根据世界卫生组织（W O）发布的信息，全球十分之九的人呼吸被污染的空气，每年有700万例过早死亡与空气污染有关，其中室内空气污染导致的死亡按疾病分解的数据：34 脑卒中；26 缺血性心脏病；22 慢性阻塞性肺病；12 儿童急性下呼吸道感染；6 肺癌。

固定无尘空间

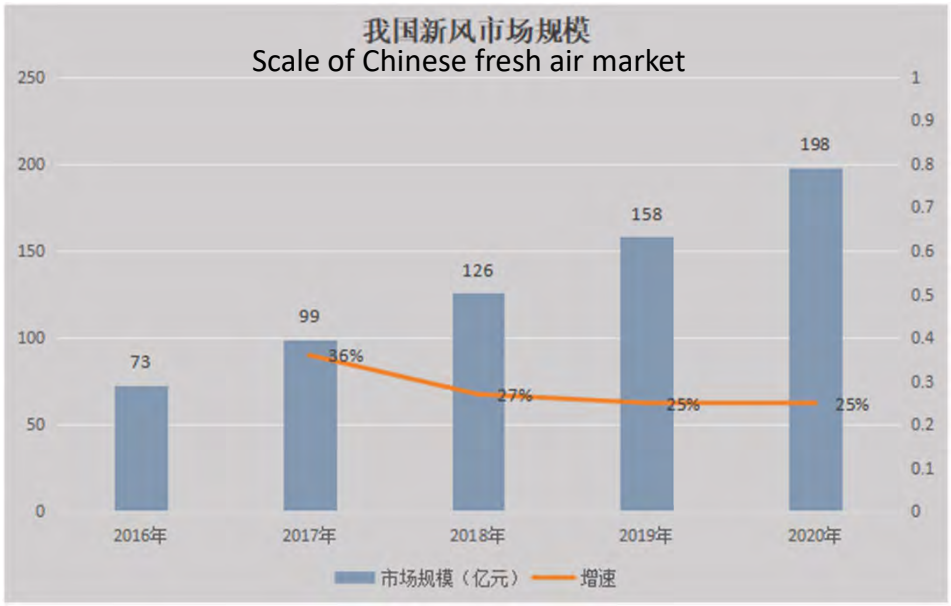
（5）行业趋势

随着我国社会与经济的发展，人民群众对美好生活的向往推动了诸多行业的发展进步。人们对室内环境品质，尤其是家居环境品质的关注度快速提升。暖通系统（KYDF），即采暖、通风、空气调节系统，对维护室内环境品质起着重要作用，良好的暖通系统配置对室内空气质量也有着积极作用。

现代人类，尤其是城市人口，绝大多数时间都在室内度过，室内空气质量对大众影响甚大。根据美国环保总局数据，室内空气质量比室外糟糕约 8#倍。二十世纪 :3#年代空调系统普及之后，出现了病态建筑综合症（Vlfn#Exlogloj#V|qgurp h/#简称 VEV），指不是由疾病或者很确定的病理引起的，人员在建筑内不同停留时间后对健康或者舒适的不良反应。研究证明，病态建筑综合症主要是因为室内空气污染严重、二氧化碳浓度过高、光照不良、热舒适度缺乏等造成。

在暖通空调机组中，一般采用液体气化制冷的原理（即冷媒）为空气调节系统提供所需冷量，用以抵消室内环境的热负荷；制热系统为空气调节系统提供所需热量，用以抵消室内环境冷暖负荷。通风系统进气口通常会吸入灰尘颗粒、化学污染物、有害病毒和细菌及其他有毒颗粒，这些物质会被过滤器捕获或是停留在通风管道及其他区域，可能会导致严重的健康风险。因此，保持通风系统处于良好的清洁状态和卫生条件有助于避免系统中堆积有害颗粒物扩散。

新风系统是由新风换气机及管道附件组成的一套独立空气处理系统，新风换气机将室外新鲜气体经过过滤、净化，通过管道输送到室内。新风系统还细分为单向流、双向流和置换送风等多种模式。置换通风是一种前沿的通风技术，可使人停留区具有较高的空气品质、热舒适和通风效率，同时也可以节约建筑能耗。



在舒适空间领域，室内空气质量是极易被忽略的。我们更关注地面是否清洁，是否有及时洗手更衣，而我们忘记了最关键的一点——呼吸。无论你是谁，无论你在哪，每个人的呼吸是无差别的，我们对干净空气的需求是无差别的。

室内空气并不像我们想的纯粹，除含氧气、二氧化碳、氮气等常规气体外，还存在很多我们容易忽略的物质，如灰尘、扬尘、花粉、颗粒物、重金属、放射性元素等。随着人们对自身健康越来越重视，对于生活空间的空气净化升级刻不容缓

再升科技凭借多年深耕“干净空气”技术和材料的优势，为舒适空间提供“低碳无尘空间”的解决方案与技术产品。广泛应用于民用住宅、商用办公场所、社交场所、绿色家电等固定场景。

In the field of comfortable spaces, indoor air quality is easily overlooked. We are more concerned about whether the ground is clean and whether we wash hands and change clothes in a timely manner, but we have forgotten the most crucial point - breathing. No matter who you are or where you are, everyone's breathing is indistinguishable, and our demand for clean air is indistinguishable.

Indoor air is not as pure as we think. In addition to conventional gases such as oxygen, carbon dioxide, nitrogen, there are also many substances that we easily overlook, such as dust, dust, pollen, particulate matter, heavy metals, radioactive elements, etc. As people attach increasing importance to their own health, it is urgent to upgrade the air purification in their living spaces

With the advantages of years of deep cultivation of "clean air" technology and materials, Zaisheng Technology provides "low-carbon and dust-free space" solutions and technical products for comfortable spaces. Widely used in fixed scenarios such as civil residences, commercial office spaces, social spaces, and green home appliances.

根据中商产业研究院数据，2016至2020年，我国新风系统市场规模由73亿元增至198亿元。尽管过去几年我国新风系统市场规模呈持续增长趋势，但其渗透率依旧较低，长期成长空间较大。

According to data from the China Academy of Commerce and Industry, from 2016 to 2020, the market size of China's fresh air system increased from 7.3 billion yuan to 19.8 billion yuan. Although the scale of China's fresh air system market has shown a continuous growth trend in the past few years, its penetration rate is still low and there is a large room for long-term growth.

再升科技在固定无尘空间

目前国内的室内空气质量和舒适度一般由暖通空调机组、新风系统、地暖系统等单个或者多系统解决。多系统叠加使用，存在对室内层高占用大，使用能耗高、噪音大，美观度不够，易造成室内二次污染等问题。公司子公司再升净化，依托 53#年干净空气领域的丰富经验，组建专业团队，针对高端民用市场，打造再升家居舒适无尘空调。

再升家居舒适无尘空调将新风净化、制冷制热、除湿加湿、变风量智能监测、智能控制集合于一套系统，为用户提供定制化全屋舒适系统，结合公司丰富的S干净空气c材料、专业的设备和一流的技术，力求为用户营造节能、无尘、安静、富氧、美观、智管的高品质生活，努力抓住消费升级、物联网高速发展的趋势，推动干净空气，向用户端发展，提供服务，找准企业定位和竞争优势，在舒适家居领域搭建系统集成生态。

再升家居舒适无尘空调系统的S无尘ô，是指运用再升科技丰富的干净空气材料和技术，高效去除空气中的颗粒污染物和气体污染物，保障空调管道无灰尘积累，无需如传统中央空调系统需要进行管道清灰等维护。再升科技干净空气材料赋能，高效净化室内空气，去除颗粒污染物和气体污染物/保障人均新风量，针对具体设计要求，采用定风量2变风量末端，精确、自动控制不同房间和区域的新风量。不同于空气净化器只是室内空气循环净化，也不同于新风系统的中效净化少量送风，再升无尘空调系统可以持续引入室外干净新鲜空气，排除室内过量二氧化碳，让人睡眠中不缺氧，氧足精神享受生活。

再升无尘舒适家居空调系统可与再升科技保温玻璃棉产品系有机结合，打造居住环境舒适宜人、室内空气质量优异、能耗近乎零的房屋。综合考虑在建筑布局、朝向、体形系数和使用功能方面的需求和建筑所在地的气候条件，保温玻璃棉产品系用于建筑非透明维护结构，可以优化建筑整体气密性，提高建筑隔热保温性能，减少室内外能量传递，降低建筑制冷取暖能耗。随着我国生态文明建设的不断深入，全社会对绿色建筑的理念、认识和需求逐步提高。公司将紧跟政策方向，紧抓技术提升，增加产品产能，不断满足绿色建筑市场需求。

家居舒适无尘空调

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俗称的空调，实际上指的是冷气，而非专业术语“空气调节”，冷气是建筑体降温的方法之一，虽然普 遍使用，却不是最好的方法。

Wkh#frp p rq|#nqrzq#dlu#frqglwlrqlqj#dfwxdo|#uhihuv#wr#frog#dlu/#udwkhu#wkdq#wkh#surihvvlrqdo#whup # %dlu#frqglwlrqlqj%#Frog#dlu#lv#rqh#ri#wkh#p hwkrgv#iru#frrolqj#exloglqjv/#dowkrxjk#z lgho|#xvhg/#lw#lv# qrw#wkh#ehvw#p hwkrg1

而真正意义上的**空调是空气调节系统**，能够处理室内空气的**温度、湿度、洁净度和气流速度**的技术，

可使某些场所获得具有一定温度和一定湿度的干净空气，以满足用户的舒适需求。

Lq#wkh#wuxh#vhqvh/#dlu#frqglwlrqlqj#lv#dq#dlu#frqglwlrqlqj#v|vwhp #wkdw#fdq#kdqgoh#wkh#whp shudwxuh/# kxp lglw|/#fohdqolqhvv#dqg#dluiorz#vshhg#ri#lqgrru#dlu/

Lw#fdq#surylgh#fohdq#dlu#z lwk#d#fhuwdlq#whp shudwxuh#dqg#kxp lglw|#lq#fhuwdlq#sodfhv#wr#p hhw#wkh# frp iruw#qhhgv#ri#xvhuv1

Customization
Design
Construction
Intelligent Pipeline

定制 设计
施工 智管

再升无尘空调，干净空气品牌中的“爱马仕”

]dlvkhqj#krph#frpiruwdeoh#dqg#khdowk|#dlu#frqglwlrqlqj/
Wrs#ox{xu|#dprqj#fohdq#dlu#eudqgv

始终关爱着您的空气环境，让每一次呼吸都成为至臻体验

让您和家人无限乐享纯净呼吸。

把奢侈品带回家，把您的干净空气带回家。

Dozd|v#fdulqj#iru#|rxu#dlu#hqylurqphqw#pdnlqj#hyhu|#
euhdwk#d#shuihfw#h{shulhqfh/#doorzlqj#|rx#dqg#|rxu#
idplo|#wr#hqmr|#sxuh#euhdwklqj#lqilqlwho|1

Eulqj#ox{xu|#jrrgv#krph/#eulqj#|rxu#fohdq#dlu#krph

家居舒适无尘空调

Krp h#Frp iruwdeoh#dqg#Khdowk|#Dlu#Frqglwlrqlqj

私人定制、用心追求的独特体验；

无尘 0内置 KHSD 过滤器，KHSD 是目前国际公认最好的高效过滤器， 对于 314 微米和 316 微米的有效率达到 <<1<:%；

静音 0内机外置室内无风机，无噪音，解决了室内设备叠加所产生的噪音与空间挤占的困扰；

节能 0智能捕获温度、湿度、SP 518、二氧化碳浓度 等指标的变化，按需送风/节能效率高达63(。

D#xqltxh#h{shulhqfh#wkdw#lv#fxvwrp l}hg#dqg#sxuvxhg#zlwk#ghglfdwlrq>

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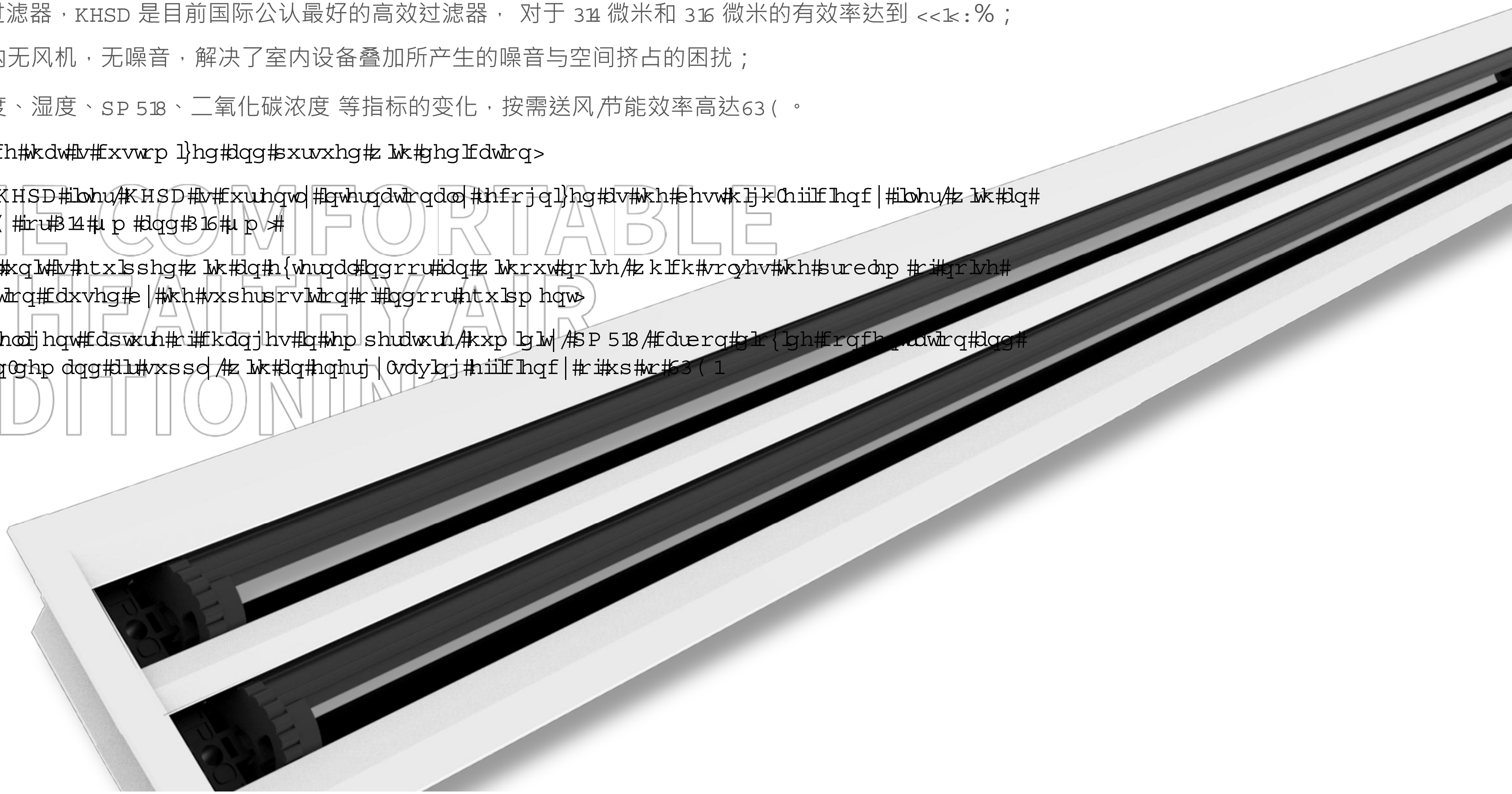
HOME COMFORTABLE
AND HEALTHY AIR
CONDITIONING



Composite Melt-blown Filtration Material

高效低阻复合熔喷滤料

高效低阻复合熔喷滤料采用无毒无味的聚丙烯颗粒，经高温加热-熔融-喷丝-牵引等工序，通过独特的静电驻极技术处理后的熔喷材料与其他过滤材料进行骨架复合成型，既克服了熔喷自身强力小的缺点，又发挥了其优良的过滤性能，从而达到完美的综合过滤效果。

Composite melt-blown filtration material is made from polypropylene granules with heating, melting, blowing and tracking process. After electrostatic electrizing, the melt-blown material will be composed with boning material which will solve its low strength problem and keep its high filtration performance to have a great filtration result.

是民用级空气净化材料的首选，符合大众需求，创造洁净生活。

It Is A Premier Choice For Civil Air Filtration Use.

- 优异的机械性能，硬挺度、抗拉强度、抗撕破能力出色
  Excellent mechanical properties, excellent stiffness, tensile strength and tear resistance
- 超低风阻，节能风力
  Low air resistance
- 国际领先静电驻极技术，续航使用寿命（一般建议周期3-6个月）
  International leading electrostatic electret technology, long service time (3-6 months)
- 低成本，高效率
  Low cost, high efficiency
- 性能延展性强，使用范围广
  Various application environment

Application Area

应用领域

广泛用于家用空气净化器、吸尘器、汽车空调、口罩防尘等。

Domestic air purifier, vacuum cleaner, car air conditioning, mask.

固定无尘空间

（4）相关政策

《第十四个五年规划和 5368#年远景目标纲要》提出对推行新型城市建设，推广绿色建材、装配式建筑和钢结构住宅，建设低碳城市，强调加快发展方式绿色转型。住房和城乡建设部将绿色建筑定义为S在全寿命期内节约资源、保护环境、减少污染，为人们提供健康、适用、高效的使用空间，最大限度地实现人与自然和谐共生的高质量建筑ð。

新版《绿色建筑评价标准》（JE2W846890534<）确立了S以人为本、强调性能、提高质量d的绿色建筑发展新模式，提出了S安全耐久、健康舒适、生活便利、资源节约、环境宜居d的指标体系。绿色建筑要综合考虑各地的气候特点、地理环境、自然资源等因素，采用适宜的外墙外保温体系、外窗保温隔热系统、通风系统、自然采光、太阳能与建筑物一体化、绿色建材和智能控制等各项技术。

5355#年 6#月，《住房和城乡建设部关于印发S十四五d建筑节能与绿色建筑发展规划的通知》指出，到 5358#年，城镇新建建筑全面建成绿色建筑，建筑能源利用效率稳步提升，建筑用能结构逐步优化，建筑能耗和碳排放增长趋势得到有效控制，基本形成绿色、低碳、循环的建设发展方式，为城乡建设领域 E363#年前碳达峰奠定坚实基础。

更广泛的绿色建筑定义包含设计、建造或运营中减少或消除负面影响，并能对我们的气候和自然环境产生积极影响的住宅、办公室、学校、医院等各类用途建筑。其包括使用绿色能源，良好的室内环境，使用无毒无害的建筑材料，高质量的建筑设计和适应气候变化。

固定无尘空间

（5）行业趋势

根据中国建筑节能协会《中国建筑能耗研究报告（5353）》，建筑运行阶段占全国能源消费总的比重为 541:（，建筑运行阶段碳排放占全国碳排放的比重为 541<（。

根据加利福尼亚大学洛杉矶分校论文《用于节能建筑围护结构的相变复合材料（Skdvh#Fkdqjh#Frp srvlwh#P dwhuldov#ru#Hqhuj|#Hiilflhqw#Exloglqj#Hqyhorshv）》指出，各类商用和民用建筑中，采暖和制冷等需求消耗的能源占建筑运行消耗总能源的三成以上。

建筑运行中，建筑墙体的隔热性能对建筑能耗和室内舒适度有显著影响。建筑围护结构中的保温层，可以减少室内热量向室外散失，降低建筑采暖和制冷的能耗，提高建筑的舒适度。建筑保温材料的性能受外部环境的影响，例如冷暖空气中的水蒸气在保温层的冷凝会引起材料恶化，缩短使用寿命，滋生霉菌等不良影响。

常见的建筑保温材料有机材料、无机材料和复合材料，如珠岩板、聚苯颗粒板、硬质发泡聚氨酯、岩棉、矿棉、玻璃棉、气凝胶等，而玻璃棉因具备优异吸音保温性能，质轻柔软、平价易获、生物安全，具备良好的市场前景。

再升科技在固定无尘空间

公司为打破国外垄断，围绕高品质生活，积极布局再升家居舒适无尘空调系统，研发生产建筑节能材料。目前，再升家居舒适无尘空调系统团队积极开展工作，持续推行产品研发，为诸多客户打造节能、静音、无尘的舒适家居环境。

围绕服务于绿色建筑的隔热保温需求，依托再升科技在超细微纤维玻璃棉的技术研发实力和行业品牌优势，潜心研发和生产更节能、更环保、更高效的高端玻璃棉，为绿色建筑提供出色的建筑保温解决方案。

公司开发出系列以微纤维玻璃棉为核心材料的绿色建筑保温产品，包含烤箱保温棉、彩色玻璃棉、工业保温玻璃棉等多种产品，具有优异的物理性能、良好的导热系数、轻质阻燃、低吸水性。其可广泛用于家用电器、公共建筑、农业畜牧业、智慧化厂房等建筑保温领域，也能与装配式建筑、EIS Y（Exlogiqj#Iqwhjudwhg#Skrwryrowdlf/#光伏建筑一体化，、被动房、QHW0JHUR#建筑（Qhw#hur#Hqhuj|#Exlogiqj，近零能耗建筑）等应用配套。公司将积极拓展、推广绿色建筑保温产品应用，为绿色建筑领域贡献力量。公司的超细微纤维玻璃棉均匀细长，长径比适中，机械性能优异，具备良好的吸音隔热性能。

公司微纤维玻璃棉是绿色环保、生物安全的产品，已取得欧洲矿棉产品认证委员会（Hxurshdq#Fhuwlilfdwlrq#Erdug#ru#Plqhudo#Zrro# Surgxfw，简称 HXFHE）非致癌认证和德国弗劳恩霍夫应用研究促进协会（Iudxqkrihu0Jhvhoovfkdiw，简称 Iudxqkrihu）实验室生物降解性认证。公司的微纤维玻璃棉通过了 UrKV#和 UHDFK#的检测，并取得认证。基于公司的超细微纤维玻璃棉的多种优良特性，公司深度挖掘材料潜力，研发生产出系列用于绿色建筑领域的产品。

再升无尘舒适家居空调系统可与再升科技保温玻璃棉产品系有机结合，打造居住环境舒适宜人、室内空气质量优异、能耗近乎零的房屋。综合考虑在建筑布局、朝向、体形系数和使用功能方面的需求和建筑所在地的气候条件，保温玻璃棉产品系用于建筑非透明维护结构，可以优化建筑整体气密性，提高建筑隔热保温性能，减少室内外能量传递，降低建筑制冷取暖能耗。随着我国生态文明建设的不断深入，全社会对绿色建筑的理念、认识和需求逐步提高。公司将紧跟政策方向，紧抓技术提升，增加产品产能，不断满足绿色建筑市场需求。

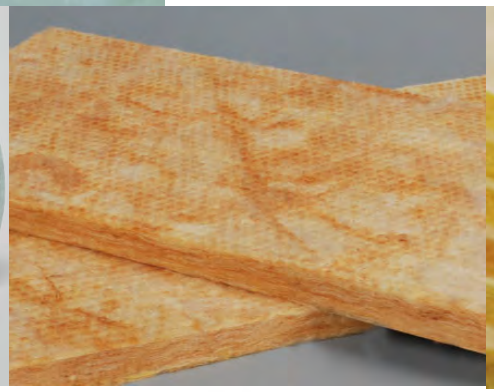
Glass wool insulation material
玻璃棉保温材料

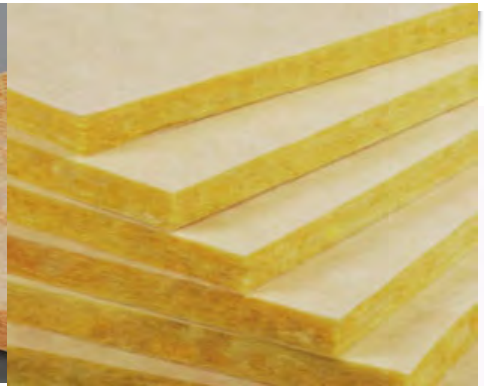
再升玻璃棉保温产品采用再升科技独有的先进超细离心棉生产技术，并在各环节传统生产工艺上进行了一系列的改良升级。相比于普通玻璃棉厂商，我们的产品生产制造过程大幅减少了资源的损耗和废弃物的排放，专利技术制造出更均匀细长的玻璃纤维，长径比适中，反弹性优异，保温吸音性能更加卓越。

我们坚持"取与自然，回归自然"，采用特制环保胶粘剂，产品无有害气体释放，手感柔软舒适，不扎手、不致敏、可降解，具有生物安全性。

The Glass Cotton Insulation Product adopts the advanced ultra-fine centrifugal cotton production technology unique to Zaisheng Technology, and has undergone a series of improvements and upgrades in traditional production processes at various stages. Compared to ordinary glass wool manufacturers, our product production and manufacturing process significantly reduces resource loss and waste discharge. Patented technology produces more uniform and slender glass fibers with moderate aspect ratio, excellent resilience, and superior insulation and sound absorption performance.

We adhere to the principle of "taking from nature and returning to nature", using specially made environmentally friendly adhesives. The product has no harmful gas release, a soft and comfortable feel, is not prickly, non allergenic, and biodegradable, and has biological safety.





产品检测认证

BCCA

BCCA

EUCEB CERTIFICATE

BCCA, independent Certification Body designated by the scheme owner EUCEB, declares that all requirements have been met to attest that the products to which the right to use the EUCEB Trademark is granted and that are manufactured by

Chongqing Zaisheng Technology Corp.,Ltd.
no 1, Chanyi Road, Huixing Street, Yubei District CN - 401120 Chongqing

in the plant situated at

Dazhou City, Sichuan Province - China

are made of fibres with a chemical composition that lies within the chemical range of the reference fibre

Mineral Wool Glass Microfiber

that has successfully been tested

in accordance with Note Q of the Regulation (EC) No 1272/2008 of the European Parliament and of the Council as currently in force

as given in report No 02G16009 of 21-07-2017.

This certificate is granted on the basis of the Implementation Rules TRA-BEUC-511 for EUCEB Certification of mineral wool products.

N° certificate BEUC-511-21267-430-21268 I Valid from 31-05-2021 until 30-05-2024
Furnace: 7

Issued in Brussels, on 20 April 2021.

ir. B. De Blaere,
President of the General Management
Committee for Certification and Approval

The validity of this certificate can be checked on the website www.bcca.be
Further clarification regarding the scope of this certificate and the applicability of the requirements may be obtained from the certified organisation

BELGIAN CONSTRUCTION CERTIFICATION ASSOCIATION NPO
FOUNDERS: BBRI AND SECO
RUE D'ARLON 53, B – 1040 BRUSSELS
TEL. + 32 2 238 24 11
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EUCEB证书
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中国合格评定国家认可委员会

实验室认可证书

（注册号：CNAS L17383）

兹证明：

重庆再升科技股份有限公司技术中心

（法人：重庆再升科技股份有限公司）

重庆市渝北区回兴街道蟑衣路 1 号，401120

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生效日期：2022-11-11
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ITEM

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Internet http://www.item.fraunhofer.de
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Toxicology and Environmental Hygiene
Phone +49 (0) 511/83 50-521
Email roman.halter@item.fraunhofer.de

Hannover, July 21, 2017

Confirmation

The biopersistence of Glass microfiber was investigated after intratracheal installation within the following study:

Fraunhofer ITEM study no.:	02G16009
Test substance:	Glass microfiber
Sponsor:	Chongqing Zaisheng Technology Corp, Ltd. No.197 Lianggang Road, Taishang Industrial Zone Yubei District, Chongqing, China

Title: The Biopersistence of Man-Made Vitreous Fibre (MMVF) Glass microfiber in Rats after Intratracheal Instillation.
This animal study was conducted in compliance with the Principles of Good Laboratory Practice (German Chemicals Law, §19a Appendix 1, August 28, 2013). The protocol of the European Commission (ECB/TM 27 Rev. 7, 1998) with slight changes according study protocol was followed.
The treatment of rats was performed in March, 2017 by intratracheal instillation of a total dose of 2 mg per rat. The fibre retention data of sacrifice dates up to 3 months after intratracheal instillation were used for analysis.

Following halftime was calculated by the method according to the protocol of the European Commission:

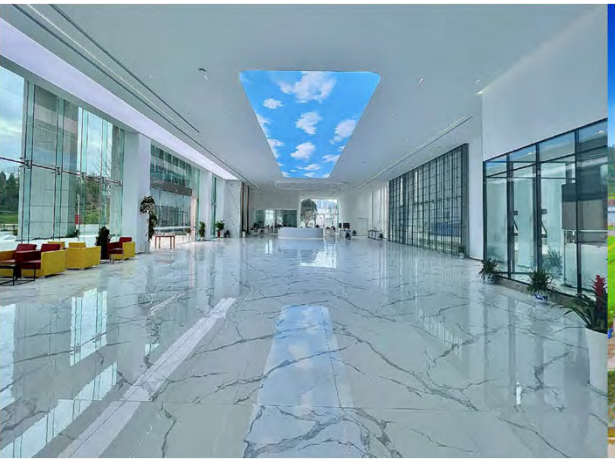
Long fibres fraction (length > 20 µm): **< 40 days**

According to REGULATION (EC) No 1272/2008 (CLP regulation), annex VI, table 3.1, INDEX-no. 650-016-00-2, Note Q, the classification as carcinogen cat. 3 does not apply to the fibre. Glass microfiber because the half-time for fibres longer than 20 µm is below 40 days in this biopersistence study after intratracheal instillation of rats.

Prof. Dr. med. Norbert Krug
Director of Fraunhofer ITEM

Dr. Roman Halter
Study director

德国Fraunhofer-生物可溶性认证
Fraunhofer certificate



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拥有亚洲最大的微纤维玻璃棉生产能力

Vlfkxdq#[xdqkdq]khqj|xdq/#qwhjudwhqj#J)G/#surgxfwrq#dqg#

p dqxidfwxulqj/#kdv#wkh#odujhvw#surgxfwrq#fdsdflw|#ri#p lfurilehu#jodvv#

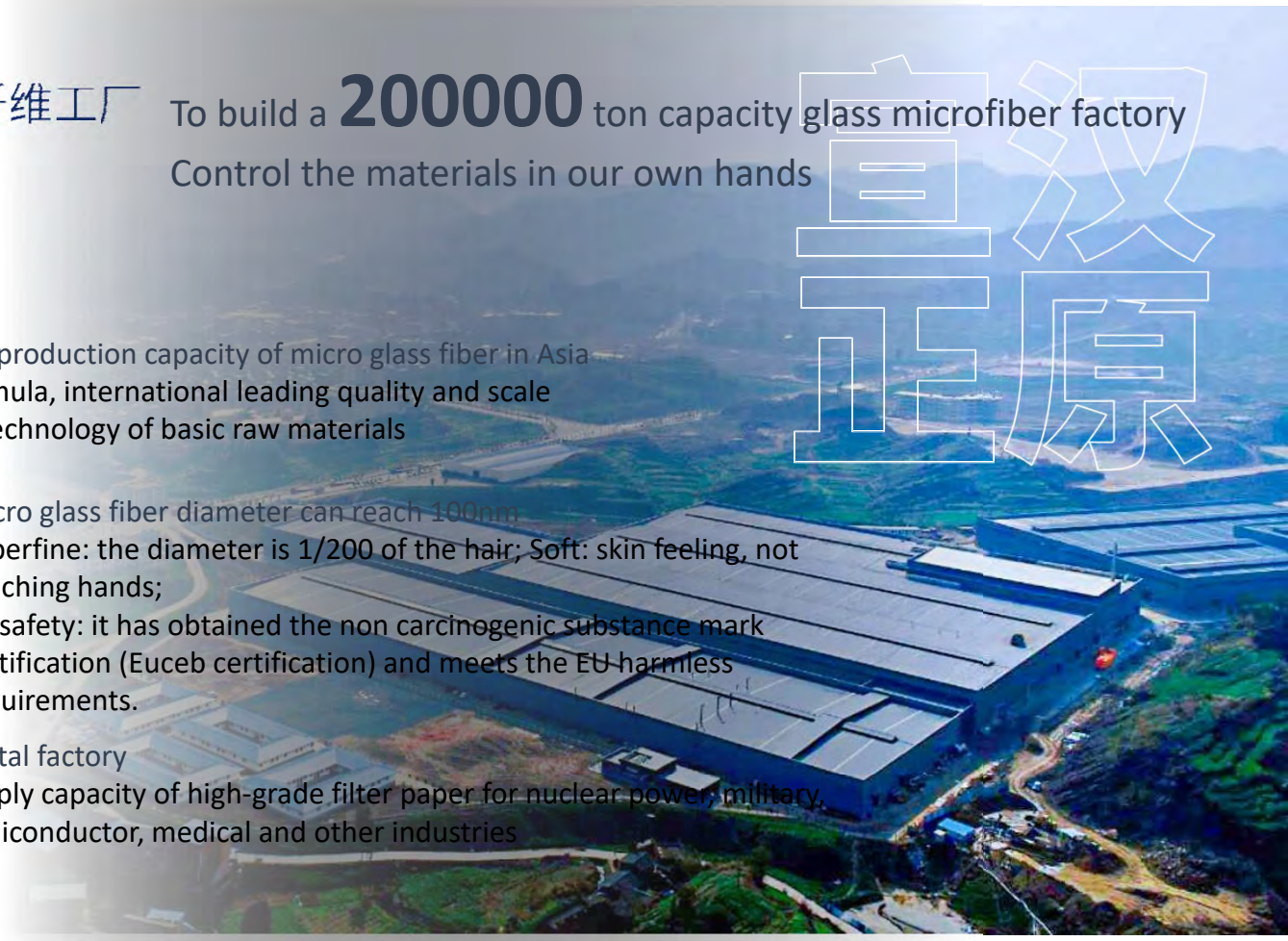
zrrd#q#Dvld

建二十万吨规模的超细玻璃纤维工厂

把材料掌控在自己手上

To build a 200000 ton capacity glass microfiber factory

Control the materials in our own hands



拥有业界最大的微纤维玻璃棉生产能力

配方独特，质量规模国际领先

拥有基础原料的领先技术

The largest production capacity of micro glass fiber in Asia

Unique formula, international leading quality and scale

advanced technology of basic raw materials

超细玻璃纤维直径最细可达100

超细-直径是头发丝的42533#

柔软-肤感、不扎手>

生物安全性-已获得非致癌物质标志认证-HXFHE 认证，

符合欧盟无害化要求。

Micro glass fiber diameter can reach 100nm

Superfine: the diameter is 1/200 of the hair; Soft: skin feeling, not touching hands;

Biosafety: it has obtained the non carcinogenic substance mark certification (Euceb certification) and meets the EU harmless requirements.

数字化工厂改造升级

形成对核电、军工、半导体、医疗等产业高档滤纸的饱和和供应能力

Digital factory

Supply capacity of high-grade filter paper for nuclear power, military, semiconductor, medical and other industries

固定无尘空间

绿色家电领域

家用电器是居民能源消耗的第二大来源，占住宅总能耗的 53（以上+供暖后，，且高达 63（的居民碳排放来自于家用电器。通过绿色家电产品结构的升级，尤其是低能耗产品在市场中的推广普及，可以有效降低居民消费端的碳排放。碳中和要求下的家电行业结构面临调整，碳排放高的企业或将面临淘汰，有持续技术创新能力的绿色生产企业迎来行业资源整合的机遇。

534<#年 9#月，国家发展改革委等七部委联合印发的《绿色高效制冷行动方案》对我国空调等制冷产品的市能效水平提出了具体要求。5355#年 ;#月，商务部等 46#部门《关于促进绿色智能家电消费若干措施的通知》，提到全面促进智能冰箱洗衣机空调、超高清电视、手机等绿色智能家电消费。提出了要完善绿色智能家电标准，推行绿色家电、智能家电、物联网等高端品质认证，为绿色智能家电消费提供指引。《中国家用电冰箱产业技术路线图+534<#年版，》针对节能明确提出，要实现冰箱节能和基本功能的综合平衡。到 2025'年，冰箱能效水平较 2019'年提高 25′，2030年较 2025'年提高 25′。

自 2021 年 3 月 1 日起，欧盟开始使用新的能效标识。新的标识刻度用 到 A 七个字母表示能效层级的递进。首批应用新标识的产品为：电冰箱、洗碗机、洗衣机和电视，其他产品也会陆续加入新版标识系统。在新版能效标识中，许多在旧标识中能获得 A 标识的产品在新系统中可能只会获得 B 级甚至 E 级的分类，节能技术的创新升级需求将获得更大空间。

再升科技在固定无尘空间

冰箱是家电中的重要组成部分，自其百余年前问世以来，其相关技术和要求一直在不断提升。作为冰箱的核心组成部件，其保温层仍然以聚氨酯为主。随着全球范围内对冰箱能耗要求不断提升，二十余年前已有将真空绝热板于冰箱的先例，真空绝热板优异绝热性能逐渐扩展到热水器、电饭锅、热水壶等多种需要绝热保温的家电中。

再升科技生产的高效无机真空绝热板芯材是真空绝热板的核心绝热材料。芯材的热阻系数、物理性能、稳定性等核心指标直接影响了真空绝热板真空度、吸水程度和导热系数，决定了制成的真空绝热板的综合性能和使用寿命。公司的真空绝热板芯材具有导热系数低，保温层厚度薄，体积小，重量轻，制造过程无氟以及容易回收再利用等优势，高效降低家用电器能耗并增加用户使用空间，已广泛用于以高端冰箱为主的多种绿色家电。公司紧抓市场机遇，不断提升产品性能，增加产品产能，以满足不断增长的市场需求。

为拓宽公司高效节能产品种类和应用领域，进一步掌握真空绝热板芯材、吸气剂和阻隔膜三种真空绝热板主要原材料的制备技术，有效提高三种原材料之间的适配性，为全球真空绝热板客户提供更专业更权威的技术服务、优质原材料和更丰富的产品种类服务，公司于 5356#年 7#月增资四川嘉豪达包装制造有限公司并成为其控股股东。未来公司将加快在高端S高效阻隔复合膜和高效吸气剂产品 的开发进度，通过新材料、新工艺、新技术，提高`高效阻隔复合膜 的抗变形、耐穿刺、耐化学等性能，降低边缘热桥效应，提升绝热性能和使用寿命，助力真空绝热板持续的迭代升级。

VIP Core Materials
VIP芯材

以直径为0.4-3μm的玻璃纤维为主要材料，采用湿法工艺制成的VIP纳米保温绝热材料，具有容重小、导热系数低、弹性好、不燃等特性。该产品质地柔软、手感好、易切裁、便于施工。适用于受空间限制和外观要求高的应用场合，是一种高级保温绝热材料。

Glassfiber VIP core material is made from glass microfiber with diameter of 0.4~3 μ m by wet laid process. It is characterized by light weight, low thermal conductivity, good flexibility, innocuity, noncombustibility, imputrescibility, aging resistance, stable chemical property and no contamination. This product is soft in texture, good at hand feel, easy to cut, applicable to the area with space restrictions and higher visual appearance requirement. It is an ideal product for advanced thermal insulation.

Dry Method VIP Core Materials
干法VIP芯材

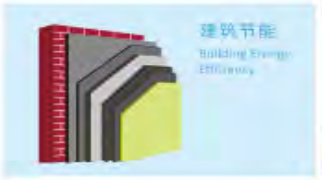
干法VIP芯材是由玻璃纤维直接加压而成的，具有高强度、低导热系数的新型芯材，生产过程不添加化学助剂，无甲醛。与传统工艺相比，干法VIP芯材具备制备成本低，导热系数更低的优点。再升科技拥有国内最先进的干法VIP芯材进口生产线。

Dry method VIP core material is new kind of core material made of glassfiber by hot press with high tensile strength and low thermal conductivity. There is non chemical agents and maldehyde-free in the whole production process. Compared with traditional process, it has the advantage of low production cost and thermal conductivity. Zisun Technology has the most advanced dry method VIP core product line of the country.

Applications 用途

适用于空调、冰箱、制冷设备、建筑节能，各种热力设备及管道的保冷、隔热法兰密封、波纹管隔热、仪器、仪表、电子、化工设备的高效绝热、隔音。

Civil and industrial refrigerators and freezers, cold storage, air conditionger, water heaters, shipping containers, nuclear containment, drying machines, heating ovens roasters, motorcycles, cars, trains, ships, building energy efficiency, etc.




移动无尘空间
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应用领域
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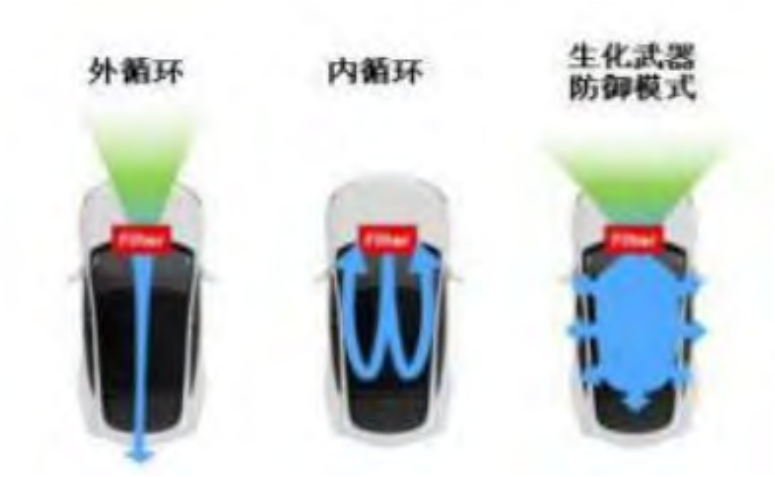

新能源汽车空气过滤
Air Filtration for New Energy Vehicles

航空航天、高铁空气过滤及隔音保温
Aerospace High-speed Rail Air Filtration and Insulation

电池隔膜
Separators for Battery

冷链运输
Cold-chain transportation and Insulation

移动无尘空间

近几年受外部环境影响，大众越发关注车厢、机舱、船舱等移动空间空气质量安全。新能源汽车结构设计的特点，为其配备大尺寸、高效率的座舱空调滤芯提供了条件。随着新能源汽车的销售量、保有量逐渐增加，新能源汽车的座舱空调滤芯迎来了巨大的市场前景。

（4）相关政策

5354#年 43#月，中共中央、国务院印发了《关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见》和《5363#年前碳达峰行动方案》，其中S碳达峰十大行动ō，明确降碳措施。方案要求，重点实施能源绿色低碳转型行动、节能降碳增效行动、工业领域碳达峰行动、城乡建设碳达峰行动、交通运输绿色低碳行动、循环经济助力降碳行动、绿色低碳科技创新行动、碳汇能力巩固提升行动、绿色低碳全民行动、各地区梯次有序碳达峰行动等S碳达峰十大行动ō。

国务院办公厅印发《新能源汽车产业发展规划（53540536 8）》中指出，我国新能源汽车进入加速发展新阶段，新能源汽车已成为全球汽车产业转型发展的主要方向和促进世界经济持续增长的重要引擎。

综合国家各种政策，发展新能源汽车是应对气候变化、推动绿色发展的重要战略举措。

（5）行业趋势

据乘用车市场信息联席会报告，5355#年全国新能源汽车累计销量 9;;1:#万辆，累计同比增长 <617（。截至 5355#年年末，全国新能源汽车保有量达 4643#万辆，占汽车总量的 714（。

汽车逐步从代步属性为主的工业品逐步变成功能需求多样化的消费品，消费者的消费体验成为购买行为的重要决定因素，整车厂从过去的 闭门造车 走向直面消费需求。随着大众对高品质生活的越发重视，汽车用户对驾驶过程中的安全、舒适、健康、智能等要求越发提升，因此打造健康、智能的新能源汽车已成为全球多家车企的发展方向，各家企业投入大量资源研发 健康汽车 。新能源汽车因其结构优势，为装配更高性能、更大尺寸、更加快速高效的汽车空调滤芯提供了条件。

已有头部新能源汽车企业提出，因空气污染将减少大众寿命预期而开发了 防生化武器级汽车，在升级更大尺寸汽车空气滤芯的同时，将过滤标的颗粒物大小从普通 PM2.5 粒径提升至医疗级常用的 PM0.3 微米粒径，并将过滤效率提高至 99.97 ，从而实现汽车座舱空气的快速、高效净化。

移动无尘空间

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随着大众对高品质生活的越发重视，汽车用户对驾驶过程中的安全、舒适、健康、智能等要求越发提升，因此打造健康、智能的新能源汽车已成为全球多家车企的发展方向，各家企业投入大量资源研发S健康汽车o。新能源汽车因其结构优势，为装配更高性能、更大尺寸、更加快速高效的汽车空调滤芯提供了条件。

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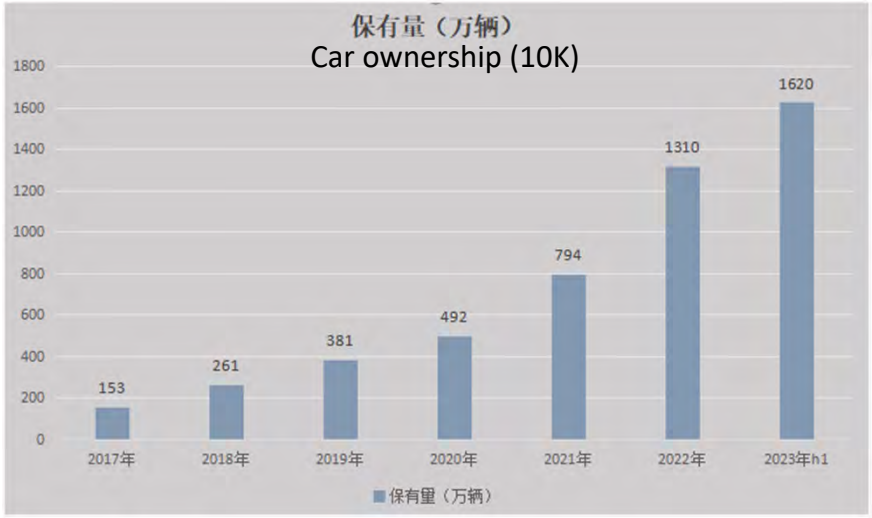
再升科技在移动无尘空间

基于再升科技多年深耕š干净空气ð技术和材料的优势，公司旗下重庆朗之瑞新材料科技有限公司为汽车座舱空气安全和空气质量提供多种过滤器，有效过滤空气中散播的细小颗粒物、气体污染物以及细菌、病毒、粉尘、气溶胶、植物花粉、霉菌孢子、尘螨排泄物等，对¹ 316µp #的颗粒物过滤效果可达 <<1:(及以上，让驾乘人员在车内享受清洁、健康的空气，可防提升驾乘舒适度、保护驾乘人员健康、提升驾驶安全性，同时防止灰尘积聚在空调系统内部，延长其使用寿命。

公司旗下生产的高效膜过滤产品，已被国际知名企业采用，应用于汽车座舱空调滤芯，为众多用户提供稳定、高效、可靠的š干净空气ð保障。公司将坚持不懈地挖掘 š干净空气ð材料和技术在新能源汽车领域的应用前景，力求为全球新能源汽车用户提供š干净空气ð的座舱环境保障。



在现代社会，航空航天、公共交通、汽车等移动式舱内空间已经成为了人们日常生产生活中不可或缺的一部分。然而，随着科技交通设备的不断增加，能源消耗和环境污染问题也日益严重，倡节能低碳已经成为了全球关注的焦点。在交通设备工业的发展中，其设备运行的能耗、噪音、舱内的安全性和舒适性等问题也越来越受到重视。

再升科技凭借多年深耕“干净空气”技术和材料的优势，为移动空间提供“低碳无尘空间”的解决方案与技术产品。广泛应用于航空航天领域、新能源汽车领域、公共交通领域、冷链运输等领域。

其中隔音隔热毯等产品应用在移动设备中能达到很好减重目的，良好的吸声降噪特性，降低设备运行过程中的能耗水平。应用于移动设备的空调过滤器相关材料产品，可有效地过滤掉空气中的各种有害物质，提高移动舱内空气质量、人员驾驶安全性、乘客乘坐舒适性、延长移动设备使用寿命。

In modern society, mobile cabin spaces such as aerospace, public transportation, and automobiles have become an indispensable part of people's daily production and life. However, with the continuous increase of technological transportation equipment, energy consumption and environmental pollution issues are becoming increasingly serious, and advocating energy conservation and low-carbon has become a global focus of attention. In the development of the transportation equipment industry, issues such as energy consumption, noise, safety and comfort in cabin operation have also been increasingly valued.

With the advantages of years of deep cultivation of "clean air" technology and materials, Zaisheng Technology provides solutions and technical products for "low-carbon and dust-free spaces" in mobile spaces. Widely used in fields such as aerospace, new energy vehicles, public transportation, and cold chain transportation.

Among them, products such as sound insulation blankets can achieve good weight reduction in mobile devices, with good sound absorption and noise reduction characteristics, and reduce the energy consumption level during equipment operation. The air conditioning filter related material products applied to mobile devices can effectively filter out various harmful substances in the air, improve the air quality in the mobile cabin, driving safety, passenger comfort, and extend the service life of mobile devices.

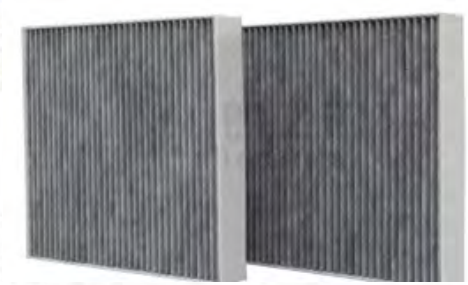
月底，全国新能源汽车保有量达到了1620万辆，占汽车总量的4.9%。这一数字的不断增长，再次展示了国内新能源汽车市场的巨大潜力，所以新能源汽车空气过滤的市场潜力也是随之增长的。

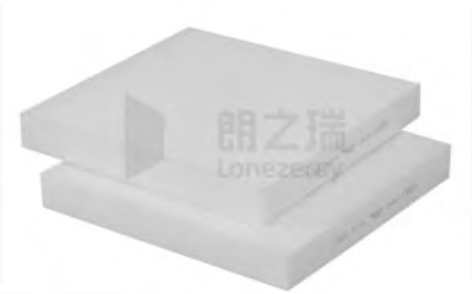
In recent years, countries around the world have been actively promoting the development of green energy, with new energy vehicles receiving much attention. According to statistics, as of the end of June 2023, the total number of new energy vehicles in China has reached 16.2 million, accounting for 4.9% of the total number of vehicles. The continuous growth of this number once again demonstrates the enormous potential of the domestic new energy vehicle market, so the market potential of air filtration for new energy vehicles is also growing accordingly.

New energy vehicle air filtration products
新能源汽车空气过滤产品

有效过滤空气中散播的细小颗粒物、气体污染物以及细菌、病毒、粉尘、气溶胶、植物花粉、霉菌孢子、尘螨排泄物等，对≥0.3μm的颗粒物过滤效果可达 99.97%及以上，让驾乘人员在车内享受清洁、健康的空气，可防提升驾乘舒适度、保护驾乘人员健康、提升驾驶安全性，同时防止灰尘积聚在空调系统内部，延长其使用寿命。

Effectively filter small particulate matter, gas pollutants, bacteria, viruses, dust, aerosols, plant pollen, mold spores, dust mite excrement, etc. scattered in the air, with a concentration of ≥ 0.3 μ The particle filtering effect of m can reach 99.97% or above, allowing drivers and passengers to enjoy clean and healthy air inside the car. It can prevent and improve driving comfort, protect the health of drivers and passengers, improve driving safety, and prevent dust from accumulating inside the air conditioning system, extending its service life





再升科技在移动无尘空间

民航飞机翱翔在万米高空时，为保证飞行中客舱货舱的温度和舒适性，飞机在蒙皮和衬里之间安装了隔音隔热层，起到反射热辐射或降低热传导的作用，实现机舱内的隔热保温、消音降噪的功能，提高座舱舒适性，降低飞机能耗和油耗。

公司高效节能产品隔音隔热毯已经获得中国商用飞机有限责任公司试验资格证书。该产品以玻璃纤维棉为原料，通过改性复合等专利工艺，拥有质轻、阻燃、防水、隔音、隔热等优异性能，可以用于飞机机舱、船舱、地铁等对隔音隔热综合性要求较高的应用领域。公司已获得航空航天质量管理体系 DV#433#认证，具有美国材料试验协会（Dp hulfdq#Vrflhw|#ru#Whvwlqj#dqg#P dwhuldov，简称 DVWP ）标准建设了声学实验室。5355#年，公司已经向中国商用飞机有限责任公司批量供应隔音隔热毯。

同时，公司研发生产的高硅氧纤维已被国际知名航天公司率先长期使用，达成了深度的商业合作，对开拓航空航天方面的高端应用具有重要意义。公司将继续努力为更多用户提供优质的国产化产品和服务。

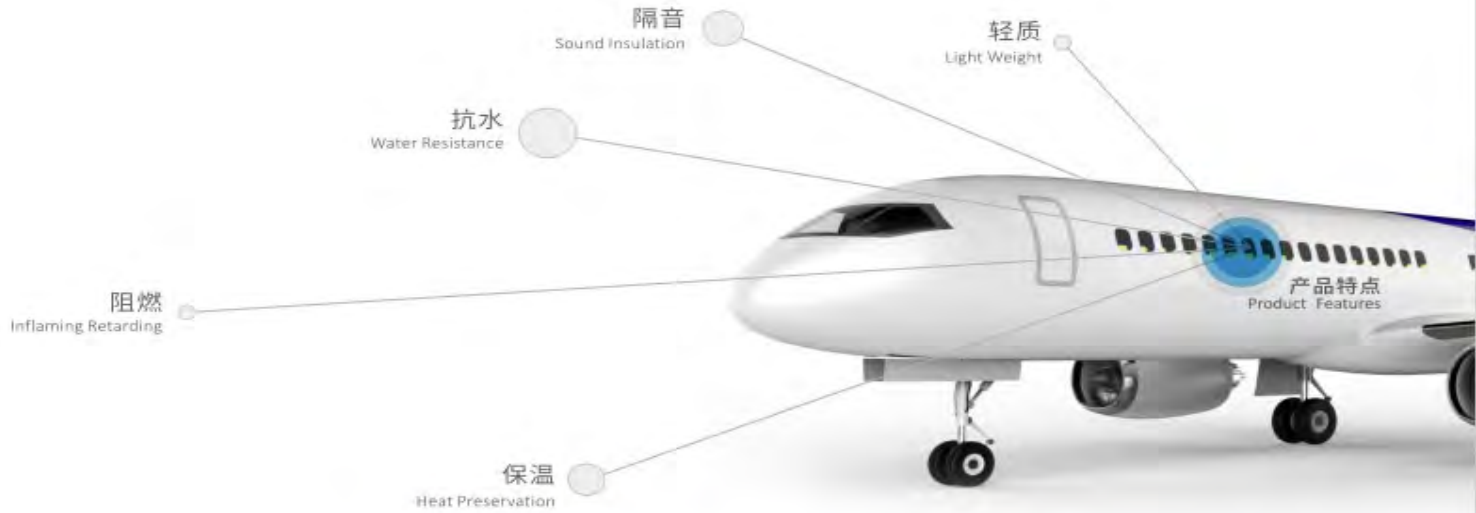
此外，中国作为"轨道大国"，在轨道交通的设计、生产和应用方面均居世界前列。近几年随着城市化加快，轨道交通的需求和建设也在加大步伐，同时新的要求不断升级、标准更高，以中国中车为代表的交轨设计制造龙头对低重量、安全性、舒适度等方面的考虑更为突出。航空隔音隔热棉在大飞机上的使用已经成熟，效果明显、反响良好，超细纤维柔软有弹性，能达到很好减重目的，良好的吸声隔热特性，使得该产品有信心在交轨运行过程中的高频噪音下表现突出，降噪系数完全可以满足相关性能要求，同时本产品具有优异的隔热保温能力，可以降低外部和内部空间的冷热交换频次，将在交轨运行过程中的能耗降到一定水平。此外，载客交轨对于安全性的重视，车厢隔音隔热材料的选用底线是满足一定防火性能要求，还有寿命设计对于车厢所用材料的耐候性要求高。我司产品本身优异的防水防火性能，能够满足一系列防寒材类要求和 **R1- L3** 轨道防火性能要求。航空隔音隔热毯轻量化、节能降噪、无毒无味、防火防水，其应用到包括地铁、轻轨、市域快轨、有轨电车、磁浮交通、其他商用货运长客等轨道交通领域将逐渐成为一种新趋势。

Sound And Heat Insulation Blanket

隔音隔热棉毡

再升科技生产的隔音隔热棉毡采用玻璃棉和一种专用粘结剂制成，具有轻质、隔音、抗水、阻燃、保湿、生物可溶性、环保等优质特点.其原材料超细玻璃纤维棉符合德国Fraunhofer研究所无害化的认证要求。通过了欧洲矿棉产品认证委员会（EUCEB)非致癌物质的认证。

Sound and heat insulation blanket is made from glass fiber and special binder. It has many advantages, such as light weight, sound proof, water resistance, flame retardant and heat insulation, bio-soluble,environmental and etc. The basic material—superfine fibre glass cotton mel the requirement of German Fraunhofer about harmlessness authentication. Passed EUCEB's authentication about non-carcinogens.



Applications 用途

隔音隔热棉毡因其卓越的声学和绝热性能被广泛运用于航空航天等高端领域，是飞机、高铁、汽车、舱体等内部空间隔音隔热的关键材料。隔音隔热棉毡由公司自主研发，为客户活动空间的安静、恒温、舒适和私密提供保障。

Because of its excellent acoustic and thermal insulation characteristics, Sound and heat insulation blanket is widely used in high-end domains. It becomes the critical materials in the sound and heat insulation of high speed rails,cars,aircrafts, transports case"etc.Our company research and develop Sound and heat insulation blanket independently. Provide a quite, thermostatic, comfortable, and private activity space for our customers.

试 验 资 格 证 书

中国商飞 COMAC

证书编号：CTEC-L210022　　版次：A

重庆再升科技股份有限公司

重庆市渝北区回兴街道两港大道 197 号，401120

符合中国商用飞机有限责任公司试验能力评估要求，具备承担本证书所列试验服务的能力。

认定试验范围如下：

专业分类：　非金属材料试验-隔音隔热材料试验

试验能力：　排水性试验；毛细现象试验；防腐蚀性能试验；耐高温性能试验；吸声系数试验；胶粘剂含量试验；流阻试验。

有效期至：2024-12-29

初次评估：2021-12-30

签署日：2021-12-30　　签字：

中国商用飞机有限责任公司

中国商飞

试验资格证书

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证书编号：CTEC-L210022

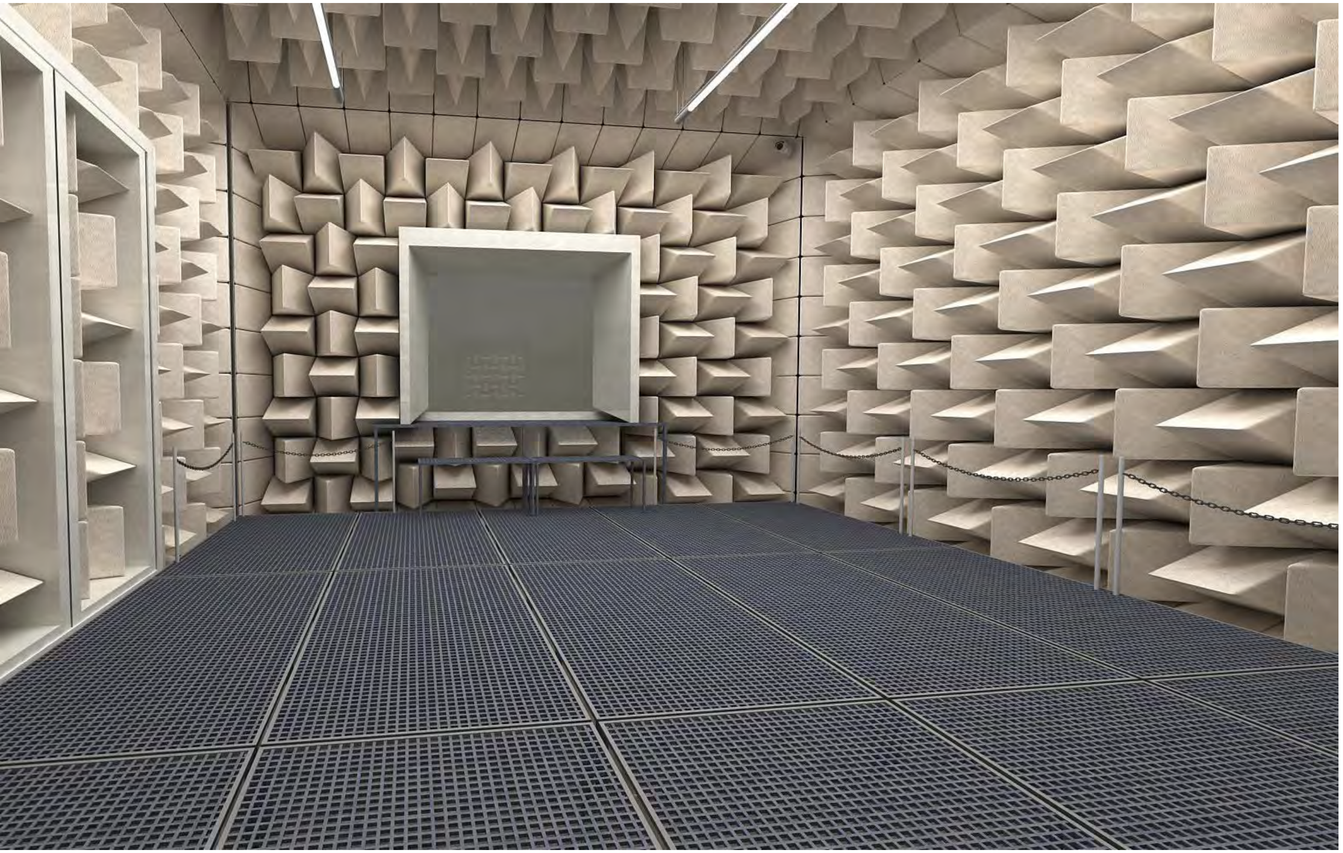
专业分类：非金属材料试验-隔音隔热材料试验

试验能力：排水性试验；毛细现象试验；防腐蚀性能试验；耐高性能试验；吸声系数试验；胶粘剂含量实验；流阻试验。

Certificate No.：CTEC-L210022

Professional Classification: Testing of non-metallic materials - Testing of sound insulation materials

Test Ability: drainage test; Capillary phenomenon test; Corrosion resistance test; High performance test; Sound absorption coefficient test; Adhesive content experiment; Flow resistance test.



ACOUSTICS LABORATORY

声学实验室

重庆再升科技股份有限公司承建的声学实验室位于重庆市

一间控制室、一间设备间组成，占地面积933平方米左右。实验室共7间房间，6间混响室、4间全消室。每两间构成一个隔声测试套组，分别采用声强法和声压法。实验室建设于弹簧之上，隔离地面振动对声学测试影响。房间外部设立双层实墙，减少声波对测试精准性的影响。

目前国内唯一的航空纤维隔音材料检测声学实验室，为国产大飞机隔音绝热材料配套。

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再升科技在移动无尘空间

冷链运输领域

冷链是指某些产品在加工、贮藏、运输、分销和零售、使用过程中，各环节始终处于产品所必需的特定低温环境下，减少损耗，防止污染和变质，以保证产品安全的特殊供应链系统。冷链已经深刻融入大众生活，适用范围非常广泛，包括初级农产品、加工食品、特殊商品（如药品、疫苗）等。冷链物流的核心组成部分之一就是“温控保温”。

5354年 45月，国务院《“十四五”冷链物流发展规划》要求：提高冷藏车发展水平，如加快推进轻型、微型新能源冷藏车和冷藏箱研发制造，积极推广新型冷藏车、铁路冷藏车、冷藏集装箱；促进运输载器具单元化，如引导冷链运输企业使用标准化托盘、周转箱（筐）、笼车等运载单元以及蓄冷箱、保温箱等单元化冷链载器具，加强标准化冷链载器具循环共用体系建设；提高冷链物流设施节能水平，如提高冷库、冷藏车等的保温材料保温和阻燃性能；加大绿色冷链装备研发应用，如鼓励使用绿色、安全、节能、环保冷藏车及配套装备设施。研发应用符合冷链物流特点的蓄冷周转箱、保温包装、保温罩等。鼓励使用绿色低碳高效制冷剂和保温耗材。

此外，我国自动售货机市场前景广阔。随着物联网和人工智能技术的发展，以及近年来“无接触式”、“无人化”自助消费方式的驱动，自动售货机整体发展迅速，大多应用于商场、服务区、地铁站、酒店以及工厂、办公楼等地。自动售货机的市场发展也为新型高效、超薄的绿色保温材料带来新的增长动力。

真空绝热板的核心材料是真空绝热板芯材。真空绝热板芯材的热阻系数、物理性能、稳定性等核心指标决定了制成的真空绝热板的导热系数和使用寿命。再升科技研发生产的真空绝热板芯材，依托微纤维玻璃棉的优异性能，具有独特孔隙结构，尽可能减少传导和对流引起的热传递，性能优异，面密度均匀性和导热系数均达到国际先进水平。

再升科技在移动无尘空间

阀控式铅酸蓄电池储能

阀控式铅酸蓄电池的核心材料之一就是以微纤维玻璃棉为原材料生产的电池 DJP #隔板/它是除铅酸蓄电池正负极外俗称S第三极ð，重要性不言而喻。电池隔板置于电池的两极极板之中，防止正、负极板相互接触而发生短路，吸附硫酸电解液，是维持电池长效、稳定、高效功能的核心材料。电池隔板的微孔性、化学稳定性、机械强度等重要指标，决定了阀控式铅酸电池的深循环寿命、充电接收能力和安全性能。

公司生产电池 DJP #隔板，以自主研发生产的微纤维玻璃棉为核心原材料，具有优异的与水亲和性、耐酸腐蚀性、耐温性、耐氧化性，并且比表面积大，具有高孔隙率，吸液速度快，并具有良好的机械强度，易于加工。因公司微纤维玻璃棉的优异性能，公司的电池隔板产品杂质含量极低，保证了制成的阀控式铅酸电池的低自放电率。同时，根据不同应用领域的铅酸蓄电池对隔板要求不同，公司自行设计出不同直径和长度的微玻纤玻璃棉，很大程度上优化了产品工艺配方，对于新型铅酸蓄电池市场要求，公司深挖材料性能，紧抓市场需求，持续推行公司电池隔板产品在性能和产能上的持续提升。

High Specific Surface Area Battery Separator

高比表面积电池隔膜

高比表面积电池隔膜是以直径0.4～3um超细玻璃纤维经湿法制成的无毒、无味、洁白的产品，是阀控式密封铅酸蓄电池（简称VRLA电池）的专用核心材料。

高比表面积电池隔膜的优良性能表现在：耐酸侵蚀好，厚度均匀，高孔隙率，吸收电解液快，纵横向均有好的抗张强度，较好的压缩性能保证了一定的极群压力，良好的绝缘性能等等。高比表面积电池隔膜在电池中主要起到固定电解液，提供充放电中两极生产的氢氧复合的通道，阻碍两极活性物质脱落，减缓铅枝晶的生成，减少电解液在充放电过程中的损失，使VRLA电池达到免维护或少维护的目的，延长电池的使用寿命。

High specific surface area battery separator is one kind of environmental-protection material which is made from glass microfiber with diameter of 0.4-3um. It is white, innocuity, tastelessness and specially used in Valve Regulated Lead-Acid batteries (VRLA batteries).

It is highly porous (90-95%, @20kPa) with uniform thickness and good tensile strength (MD&CD) that can absorb more acid and it has small pore sizes to maintain electrolyte levels in the battery. Additionally, it is highly resistant to battery acid, oxidation and heat, and can maintain its shape and strength after prolonged exposure to sever environmental conditions. Customized specifications are available.

Applications 用途

UPS电源、电力系统、铁路系统、通讯设备、应急灯、防火和警卫系统、发动机、电力车和摩托车、密封式电源、太阳能、风能。

Telecommunications, Cellular phones, Uninterruptible power supplies, Emergency lighting, Power tools, Automobile, Motorcycle, UPS (Large, Small) , Load leveling, Electric vehicle, Etc.

高比表面积电池隔膜目前最大的市场需求来自汽车起停电源，约占所有VRLA电池市场需求总量的70%。

Currently the biggest market demand of high specific surface area battery separator is from auto start-stop power, which accounting for 70% of the total VRLA battery market demand.


工业无尘空间
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应用领域

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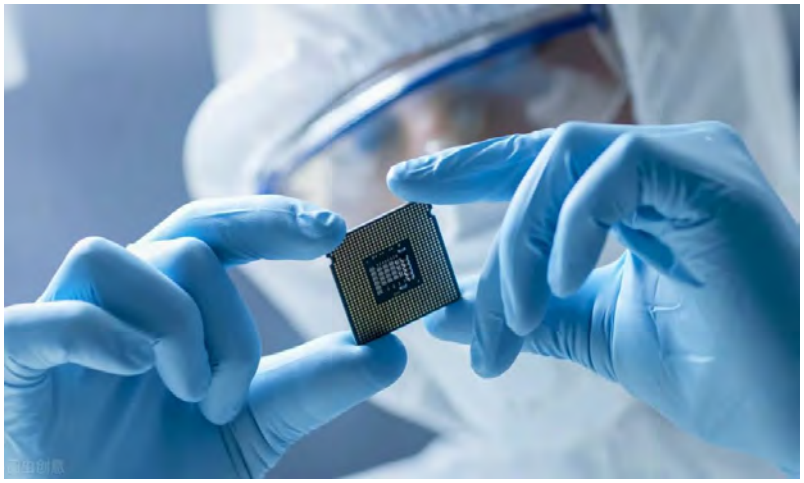


半导体、面板制造

Semiconductor and Panel Manufacturing

制药、医疗健康

Pharmaceuticals, Healthcare

核电

Nuclear power

精密仪器加工

Precision Instrument Processing

工业无尘空间

Š干净空气ć材料、设备、解决方案，可以有效保护人员健康，高端制造生产工艺流程，保护生态环境免于空气中的颗粒物（SP ，sduwlfxodwh#p dwwhu）和气态分子+DP ，dlueruqh#p rdnfxdqv,的污染物侵害。

以半导体领域为例，生产环境需要极高洁净度，空气中的颗粒污染物对产品的工艺良品率、性能和可靠性产生重大影响。《芯片制造：半导体工艺制程实用教程+P lfurfkls#Ldeulfdwrq：D#Sudfwlfdd#Jxlgh#wr#Vhp lfrqgxfwru#Surfhvvlqj,》所述，经验规则是微粒的大小要小于器件上最小特征图形尺寸的 4243#倍，即直径为 3136µp #的微粒会损害 316µp #线宽大小的特征图形。因此，管控半导体生产制程中颗粒污染物对于生产过程的经济性具有重要意义。

（4）相关政策

中央网络安全和信息化委员会印发的《Š十四五ć家信息化规划》我国Š十四五ć时期信息化发展作出部署安排。《规划》在信息领域核心技术突破工程提出，加快集成电路关键技术攻关。推动计算芯片、存储芯片等创新，加快集成电路设计工具、重点装备和高纯靶材等关键材料研发，推动绝缘栅双极型晶体管（LJEW）、微机电系统（PHPV）等特色工艺突破。

（5）行业趋势

VHPI#在《世界晶圆厂预测报告（Zruog#Lde#Lruhfdvw）》中强调，全球前端晶圆厂设备支出预计将在 5355#年同比增长 43(，达到超过 <;3#亿美元的历史新高。晶圆厂设备支出在 5353#年增长4:(，5354#年增长 6<(，这是再在继 5349#年至 534;#年后的又一个三年的增长。

SEM 发布《年终总半导体设备预测报告（ ear-End Total Semiconductor E uipment orecast OEM Perspective）》指出，预计 2021 年原始设备制造商的半导体制造设备全球销售总额将达到1030 亿美元的新高，比 2020 年的 710 亿美元的历史记录增长 44.7 。预计 2022 年全球半导体制造设备市场总额将扩大到 1 140 亿美元。

rost Sullivan 预计 2020 年至 2024 年全球洁净室投入的年复合增长率为 9 ，而国内洁净室的投入中，半导体行业的洁净室将有 20 的年复合增长。根据 rost Sullivan 所提供数据，国内洁净室的市场主要由半导体和电子行占据过半份额。

根据 S A 和 BC 预测，2021-2030 年期间中国大陆的晶圆代工产能增速在全球范围内将排名第一。洁净的环境是国内外在半导体、面板、精密仪器加工等行业顺利生产制造的重要保证，业内持续投入将推动 干净空气 材料和设备新增和更换的需求。

再升科技在工业无尘空间

半导体制造工艺中，印刷图案的关键尺寸越来越小，空气中微粒和空气传播分子污染物的控制是影响其成品率的一个关键因素。一枚晶片要历经多道工序，在整个工序链中任何微小的污染都会对其良品率、性能、可靠性造成严重影响。

在以导体、面板、精密仪器加工等先进制造领域为代表的设计的洁净室中，S干净空气o材料根据需求，将被加工成多种过滤器或者过滤单元，其过滤精度和过滤阻力对于控制生产过程中的空气污染物和节能降耗起着重要作用。

对于半导体、面板、电子、医疗等不同高端制造领域，气体分子污染物对于不同生产流程和生产工艺有不同的重大影响。化学过滤材料则是针对 YRFv#气体、DIFG#气体、EDVH#气体等纳米级分子化合物气体治理。主要原理是运用三种基于范德华力吸附、利用化学反应吸附和化学反应吸收等技术路线处理气态分子污染物。公司针对不同用户的具体生产环境和工艺要求，综合考虑需要处理的气体分子污染物粒径、化学性、浓度等要素，定制设计化学过滤材料的种类和结构，保障用户生产环境的S干净空气o。

再升科技持续深挖材料性能，推进技术进步。公司具有丰富的S干净空气o材料和设备解决方案，可以根据不同类型、等级洁净室的具体需求，提供合适的材料和解决方案，有效处理洁净室中的颗粒污染物和气体分子污染物保障洁净室内人员、设备、材料的安全运行，避免洁净室生产过程中污染物散逸，保障周围环境安全。

工业无尘空间

国内外生物医药、医疗健康行业持续增长的需求直接推动行业的“干净空气”材料和解决方案的需求。

（4）行业趋势

根据国家统计局数据，从 5344 年至 534< 年，我国卫生总费用由 57/333 亿元上升至 99/333 亿元，年复合增长率为 46157(。基于国内的人口结构、经济发展等宏观趋势和医药健康产业内的鼓励创新国产替代、国际化浪潮的大环境，我国的生物医药、医疗健康行业仍将持续蓬勃发展。麦肯锡“P fNlqvh|” Frp sdq|的《Krz FRYIG 04< Fkdqjhv Wkh Jdp h Iru Elrskdup dqq Fklqd》中提出，中国是全球第二大医药市场，也是多数全球制药企业的战略重点。

近年来，全球应对突发卫生危机能力及防控意识都极大增强。大众健康观念、消费习惯、心理素质、教育文化等都发生相应变化。放眼全球，各国对健康卫生与疾病治疗的持续重视推动行业的投入持续加大，行业融资额度持续增加，对医药、医疗的需求预计将长期持续。随着科技发展，将出现新型药物、疫苗、方舱医院和移动医院等多种需求，将直接推动相应应用场景对“干净空气”的重视程度和技术要求。

再升科技在工业无尘空间

对于物医药、医疗健康行业，可以细分为医药生物、化学原料药、医药服务、中药、医疗器械、生物制品、化学制剂等多种生产、制造、运输、储存等环境需求不同等级§干净空气¤标准的用户。

制药企业，因其生产过程中涉及到一些高活性、高毒性、致敏性、致畸性的药物或中间体，行业内建立了 RHE（rffxsdwrqdd# h{srvxuh#edqg）级职业暴露分级，进而对生产环境的生物安全提出了严格要求。JPS#要求和行业发展等多种因素地推进下，生物制药行业将生产工序密闭化的趋势明显，生物制药企业的洁净要求，空气管理严苛程度亦随之提高。

疫苗生产企业，需要同时疫苗质量和生产活动生物安全，不同防护等级的疫苗生产车间对§干净空气¤的材料、设备、技术方案提出了严苛要求。

在生物医药和医疗健康等领域，§干净空气¤的材料对于保障生产安全、人员安全有重要作用。公司多种§干净空气¤材料和技术已用于本领域洁净室的初、中、高、超高效过滤，具有高可靠性。

洁净室在众多领域有普遍应用，保障生产制造过程中制品、设备、材料不受空气中的污染物影响。常见需要使用洁净室的行业有高端制造业、各种研究机构、制药公司、医学实验室、电子零件生产、航空航天工业、光学与镜片制造、军工制造等。

在工业制造、储存及运行过程中，企业越来越重视产品的良品率和安全性以及能耗问题，为了顺应时代的发展和增强企业自身的竞争力，企业对于如何解决制造过程中遇到的固态及气态污染物和降低能耗的需求极为迫切。

再升科技凭借多年深耕“干净空气”技术和材料的优势，为工业空间提供“低碳无尘空间”的解决方案与技术产品。广泛应用于半导体、面板、精密仪器加工、生物医药、医疗健康、食品、核电、军工等领域

其中玻璃纤维滤纸为洁净室的主要过滤材料，其纤维分布均匀、容尘量大、阻力小、强度大，能有效的过滤工业制造过程中所遇到的污染物和控制不同场景的空气湿度，从而增强产品的良品率及安全性。

In the process of industrial manufacturing, storage, and operation, enterprises are increasingly paying attention to product yield, safety, and energy consumption issues. In order to comply with the development of the times and enhance their own competitiveness, enterprises have an urgent need to solve the solid and gaseous pollutants encountered in the manufacturing process and reduce energy consumption.
With the advantages of years of deep cultivation of "clean air" technology and materials, Zaisheng Technology provides solutions and technical products for industrial spaces with "low-carbon and dust-free space". Widely used in semiconductor, panel, precision instrument processing, biopharmaceutical, medical and health, food, nuclear power, military and other fields
Glass fiber filter paper is the main filtering material for clean rooms, with uniform fiber distribution, large dust capacity, low resistance, and high strength. It can effectively filter pollutants encountered in industrial manufacturing processes and control air humidity in different scenarios, thereby enhancing product yield and safety.

经过多年发展，我国洁净室工程行业已达到一定规模。数据显示，2022年我国洁净室工程行业市场规模进一步增长，达2407.30亿元，增速为12.17%。预计2025年洁净室工程市场规模可达到3275.3亿元，其中新增过滤材料规模163.8亿元，需替换过滤材料规模107.3亿元

After years of development, the clean room engineering industry in China has reached a certain scale. Data shows that in 2022, the market size of China's clean room engineering industry further increased, reaching 240.73 billion yuan, with a growth rate of 12.17%. It is expected that the market size of clean room engineering will reach 327.53 billion yuan by 2025, with a new filter material scale of 16.38 billion yuan and a need to replace filter materials scale of 10.73 billion yuan

Glass Microfiber Filter Media
玻璃纤维空气过滤纸

玻璃纤维空气过滤纸是以玻璃纤维为主要原材料，采用湿法成型工艺制成，具有纤维分布均匀、容尘量大、阻力小、强度大等特点，**是理想的空气过滤材料。**

Glass microfiber filter media are comprised primarily of glass microfibers and are produced with a wet laid process similar to that used for the production of paper.It's a ideal filter media because of it's good characteristics.

Applications 用途

一般通风用玻璃纤维滤纸（ASHRAE）
ASHRAE grade(F6-F9)

主要用于普通空调系统、燃气轮机与空压机。
Ordinary air-conditioning system, gas turbine air intake, aircompressor, etc.

高效过滤器用玻璃纤维滤纸（HEPA）
HEPA grade(H10-H14)

主要用于万级～10万级洁净室或工作台、核电站排风、高档家用吸尘器、空气净化器、防毒面具等。
10,000 to 100,000 grade cleaning rooms or working places, air exhaust equipment for nuclear, high-grade household vacuum cleaner, airpurifier, masks, etc.

超高效空气过滤器用玻璃纤维滤纸（ULPA）
ULPA grade(U15-U16)

主要用于芯片厂及100级、10级、1级洁净厂房等。
Chip factories, 100, 10 even,1 grade cleaning rooms,etc.

为提升压缩空气的洁净度，提高压缩设备性能和寿命，保护下游工序设备，采用气液分离技术以分离气体颗粒物及油微粒。再升科技研制的油分滤纸可高效完成分离过程，油微粒经过滤纸的扩散、拦截、惯性碰撞等机理凝聚排出回收，从而使压缩机排出纯净、无油的压缩空气。这种滤纸具有孔径分布均匀、透气量好、耐破性高、过滤效率佳的特点，并可定制幅宽规格。

In order to improve the cleanliness of compressed air, improve the performance and extend the life span of compression equipments, also to protect downstream process equipments. Gas-liquid separation technology is used to separate gas particles and oil particles. The Oil-gas separation glass fiber filter paper produced by ZISUN can efficiently complete the separation process. After the diffusion, interception and inertial collision by the filter paper, the oil particles are condensed and discharged. So that the compressor discharges pureand oil-free compressed air. The Oil-gas separation glass fiber filter paper produced by ZISUN has the characteristics of uniform pore size distribution, excellent gas permeability, high bursting strength, preeminent filtration efficiency. And it can be customized in width as well.

Oil-Gas Separation Glass Fiber Filter Paper
油气分离玻纤滤纸

Applications 用途

油气分离玻纤滤纸广泛用于空压机压缩空气、汽车发动机、石油、化工、冶金、航空、电子、电力、制药、环保、原子能、天然气工程、核工业、耐火材料、消防设备等领域的固液、**气固、气液分离和净化。**

Oil-Gas Separation Glass Fiber Filter Paper Widely used in air compressor compressed air engine, automobile, petroleum, chemical industry, metallurgy, aviation, electronics,electric power, pharmaceutical,environmental protection, atomic energy, natural gas, nuclear industry, refractory materials, fire-fighting equipment, and other fields of solid liquid, gas solid, gas-liquid separation and purification.

满足超低阻力的同时实现HEPA、ULPA各等级过滤效率，
是高端空气过滤领域的不二之选。
使用该材料的过滤器及过滤设备有着明显性能优势和效果升级：

Composite PTFE filtration material is able to reach HEPA and ULPA efficiency at low air resistance and is the first choice in high-end air filtration sector.
Filters with this material have clear advantages:

A
无硼硅，无挥发，
无微尘，避免二次污染
Boron silicon free,
no volatile, no dust,
no secondary pollution

B
耗能低，节能大，平均能耗根
据不同的设计可节约40%以上
Low energy consumption,
saving more than 40%
energy in average

C
无惧环境腐蚀
(酸性、碱性、有机物)
No fear of
environmental corrosion
(acidic, alkaline, organic)

D
更高效率，更低阻力，
超大容尘能力
Higher efficiency,
lower resistance,
super dust capacity

E
耐普通撞击，
承受能力强。
Common impact resistance,
strong endurance

F
满足
UL900标准
In compliance with
UL900 standard

G
防水
性出众
Excellent water
repellency

H
独特清灰性，
可重复使用
Washable,
reusable

Composite PTFE Filtration Material
高效PTFE过滤膜复合滤料

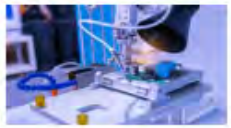
高效PTFE过滤膜复合滤料是聚四氟乙烯颗粒经特殊技术处理后通过双向拉伸形成的含有大量微孔、孔隙率极高的过滤薄膜与其他过滤材料骨架复合而成，综合了化学性质更稳定、纤维分布更均匀、过滤性能更高、阻力更低等优点，在某些特殊应用领域成为无可替代的新型高端过滤材料。

Composite PTFE filtration material is composite of a thin film that contains a large number of micropores and extremely high porosity made from polytetrafluoroethylene particles with biaxial stretching process and other filtration material as boning. It has more stable chemical properties, more even fiber distribution, higher efficiency and lower air resistance and has become an irreplaceable material in certain high-end filtration sector.

Application Area 应用领域

无尘实验室、高端食品加工、医疗、半导体、电子产品、药品生产、吸尘器、防毒面具等。

Clean room, high end food processing, medical environment, semiconductor, electronics , pharmaceutical production , vacuum cleaner and gas mask, etc.


Glass Microfiber Air-laid Mat

微纤维棉过滤毡

微纤维棉过滤毡是经特殊纤维分散器排列成型，再复合仿毡型织物而成。
广泛应用于**生物、电子、军工**等高科技领域空气微粒过滤。

Glass microfiber air-laid mat is made by special fiber dispersion and then laminated with spun-bonded fabric.

It is widely applied for air filtration for biological,electronic and military industry.

玻纤过滤袋具备玻纤织物耐高温、耐腐蚀、尺寸稳定、伸长收缩率极小、强度高、对气体过滤阻力小等优点。与其他耐高温化纤毡相比，具有价格低、运行阻力低、过滤精度高，适用于钢铁、冶金、炭黑、发电、水泥、化工等行业高温烟气过滤。

Fiberglass pocket filter possess the merits like thermostability, corrosion resistance, dimensional stability, low elongation shrinkage rate, high strength and low resistance towards gas. Compared with other high temperature resistant fiber felt, it has lower price, lower resistance, higher filtration precision, which is applicable to the steel, metallurgy, carbon black, power generation, cement, chemical and other industries of high temperature flue gas filtration.

过滤袋生产线

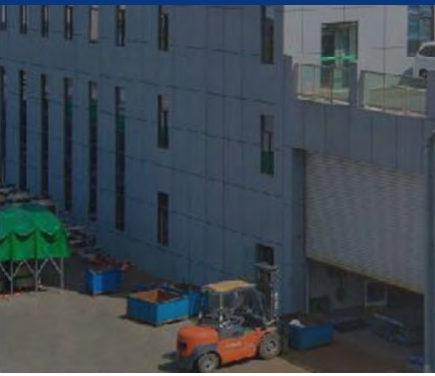
公司新引进生产线，能将微纤维棉过滤毡加工成过滤袋，满足工业需求。

Fiberglass Pocket Filter Production Line

It is a newly introduced production line, which turns glass microfiber mat into pocket filter to meet industry demand.

公司专注于超细纤维、膜材、吸附材料、微静电材料、油气分离材料及隔音隔热材料等新材料的研究，以材料为基石，深度挖掘材料的优势性能，依托公司§国家企业技术中心ð，发挥在§干净空气ð领域多年深耕的技术优势、材料优势、检测优势、研发优势和设计优势，实施强有力的融合与跨界策略，不断拓宽应用领域，为解决§三大空间ð领域空气中的能、尘、噪音提供è è

“干净空气”的应用产品及解决方案。



The company focuses on the research of new materials such as ultrafine fibers, membrane materials, adsorption materials, micro electrostatic materials, oil and gas separation materials, and sound insulation materials. With materials as the cornerstone, the company deeply explores the advantages and performance of materials. Relying on the company's "National Enterprise Technology Center", the company leverages the technical advantages, material advantages, testing advantages, research and development advantages, and design advantages that have been deeply exploited in the field of "clean air" for many years, Implement strong integration and cross-border strategies, continuously expand application areas, and provide

"clean air" application products and solutions

to address energy, dust, and noise in the air in the "three major spaces".

ABOUT ZISUN

关于再升科技

再升科技成立于533:年

是国家高新技术企业，建有国家企业技术中心

公司于5348年 4月55日在上交所主板挂牌上市

股票代码 936934

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再升科技体验中心

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打造舒适、优美、干净、科技的智能办公体验中心

配备奢侈品体验店、声学实验室、研发中心、星级办公室、蒹葭园及在森咖啡屋

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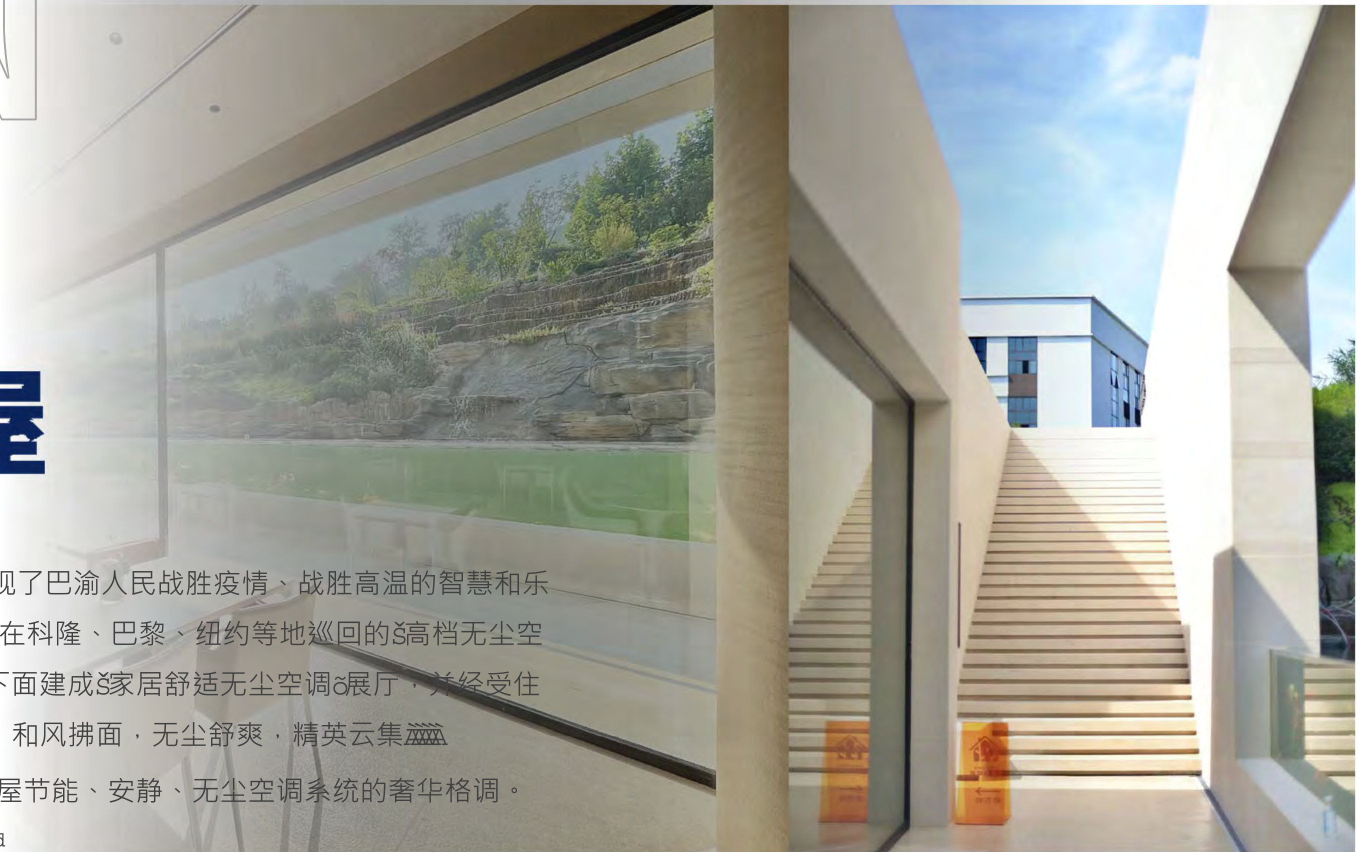
ZISUN CAFE

在森咖啡屋



在森咖啡屋0重庆网红打卡地

在森咖啡屋于5355年9月4;日建成开放，体现了巴渝人民战胜疫情、战胜高温的智慧和乐观精神。由于疫情的影响，业主方每年都要在科隆、巴黎、纽约等地巡回的Ŝ高档无尘空调系统ô展会被迫取消，无奈之下在停车场下面建成Ŝ家居舒适无尘空调ô展厅，并经受住了重庆433年最火热夏天的考验。锦鲤畅游，和风拂面，无尘舒爽，精英云集ÀÀÀÀ

Ŝ世界在窗外，森林在我家ô体现了在森咖啡屋节能、安静、无尘空调系统的奢华格调。

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蒹葭园

JIANJIA GARDEN

打造重庆首个碳中和建筑

打造绿色低碳建筑示范中心的低能耗建筑示范园区

打造特色绿色低碳示范园区

To build Chongqing's first carbon neutral building
To create a Low Energy Building Demonstration Park for Green and Low Carbon Building Demonstration Centers
To create a distinctive green and low-carbon demonstration park

以"渗、滞、蓄、净、用、排"的海绵城市建设理念，通过可视化雨水花园、多元化透水路面、绿色屋顶花园、小微湿地公园、共享空间亲水平台、趣味循环水景等生态设施，打造海绵城市特色展示区，提供新颖的体验式空间，在保障功能美观的同时，起到科普与宣传的作用，增强人与生态的互动性。

With the concept of 'infiltration, stagnation, storage, net use, and drainage' in the construction of sponge cities, through visual rainwater gardens, diversified permeable roads, green roof gardens, small and micro wetland parks, shared space hydrophilic platforms, and fun circular water features and other ecological facilities, we create a sponge city characteristic exhibition area, providing a novel experiential space, while ensuring functional aesthetics, playing a role in science popularization and publicity, and enhancing interaction between people and ecology

爱干净空气
用再升科技

OR YH#F OHDQ#DLU
XVH#LVXQ#DLU

2023 ANFA Nonwovens Conference

Hong Kong Convention and Exhibition Center
Hong Kong, 30-31 Oct. 2023

Nonwoven Market Trends after the COVID-19 Pandemic- How Textile Industry Mingle with NonWovens

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Laboratory of Wearable Materials for Healthcare

ANFA Asia Nonwoven Fabrics Association

香港城市大學
City University of Hong Kong

HK ANFA 2023

2023 ANFA Nonwovens Conference

HKNA

Hong Kong Convention and Exhibition Center

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CityU 香港城市大學 City University of Hong Kong

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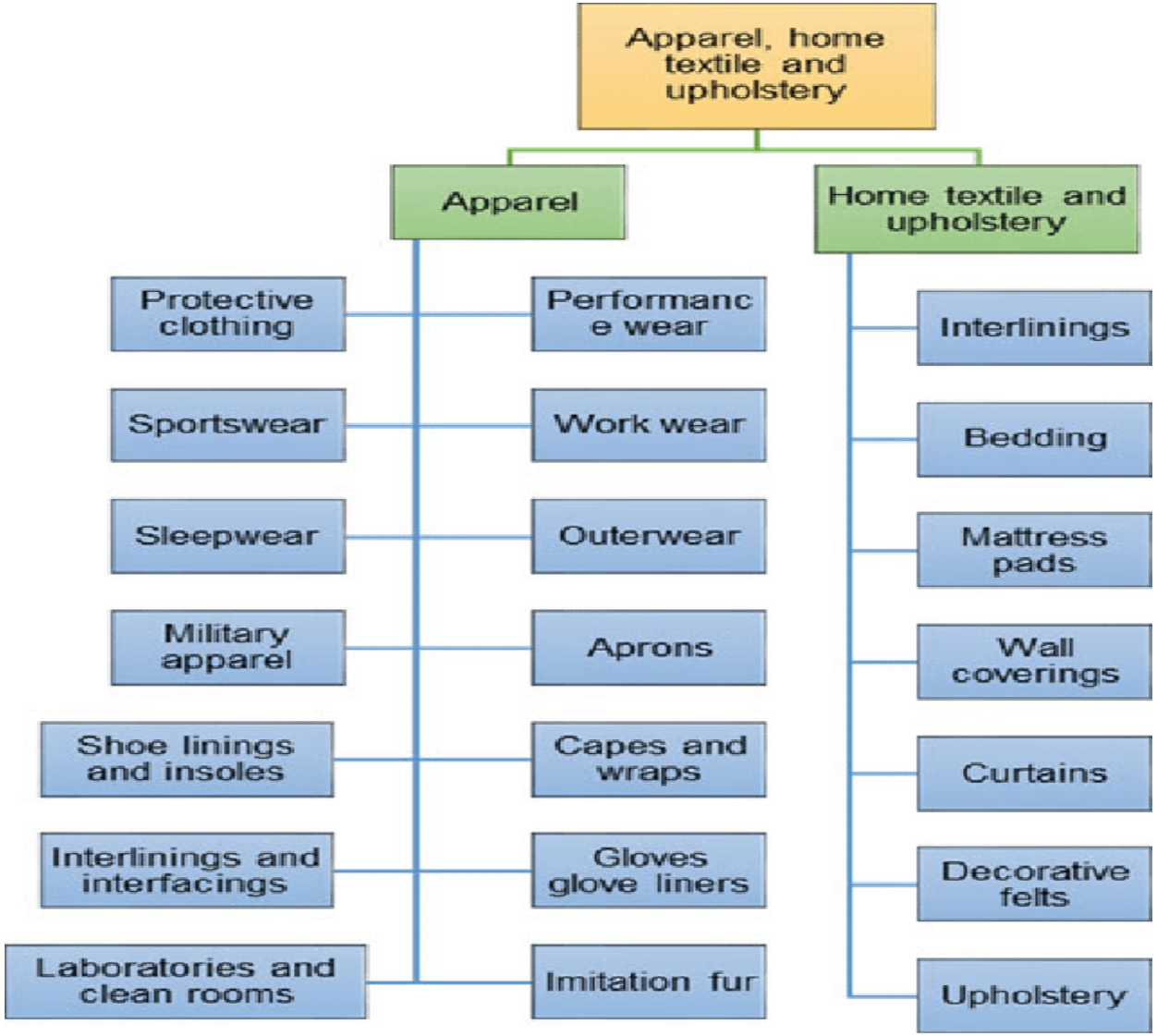
Nonwovens in Apparel and Textiles

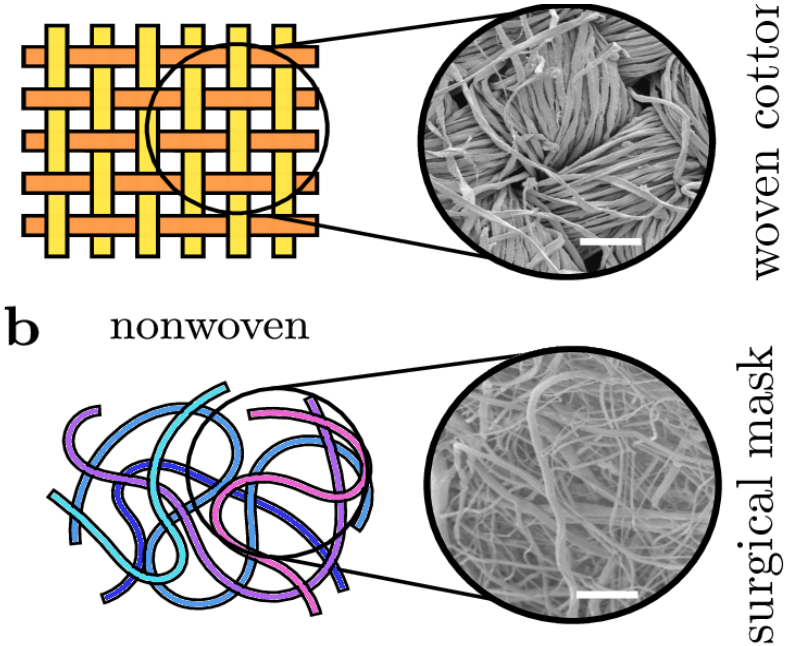


Advantages of Nonwovens

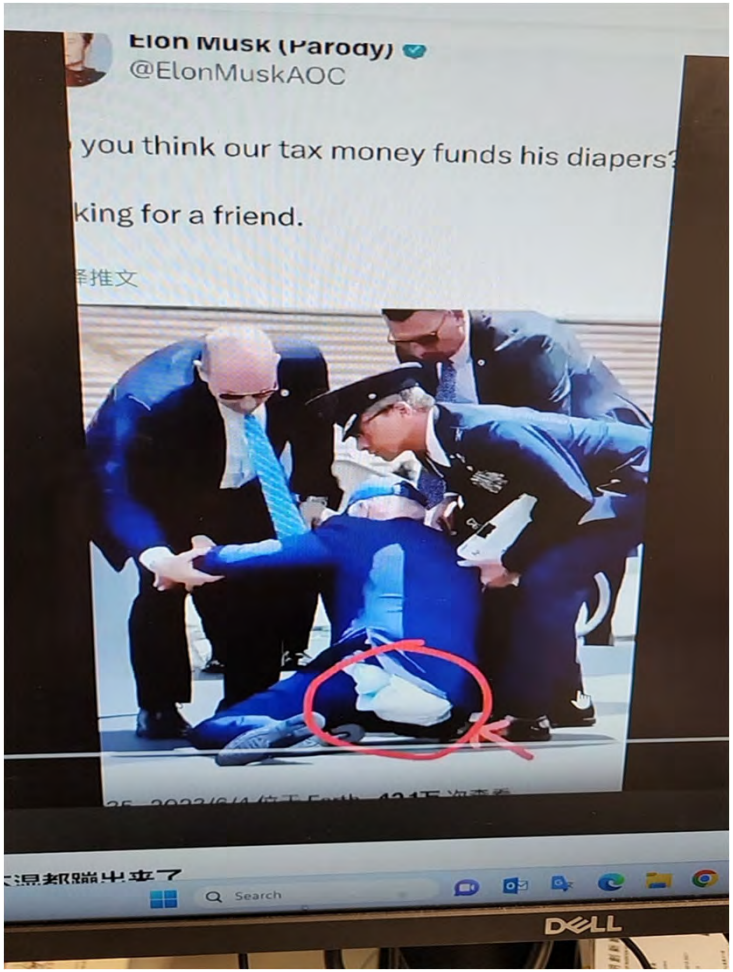
Continuous web, without yarn structure

- Versatility
- Lightweight nature
- High productivity
- Cost-effectiveness

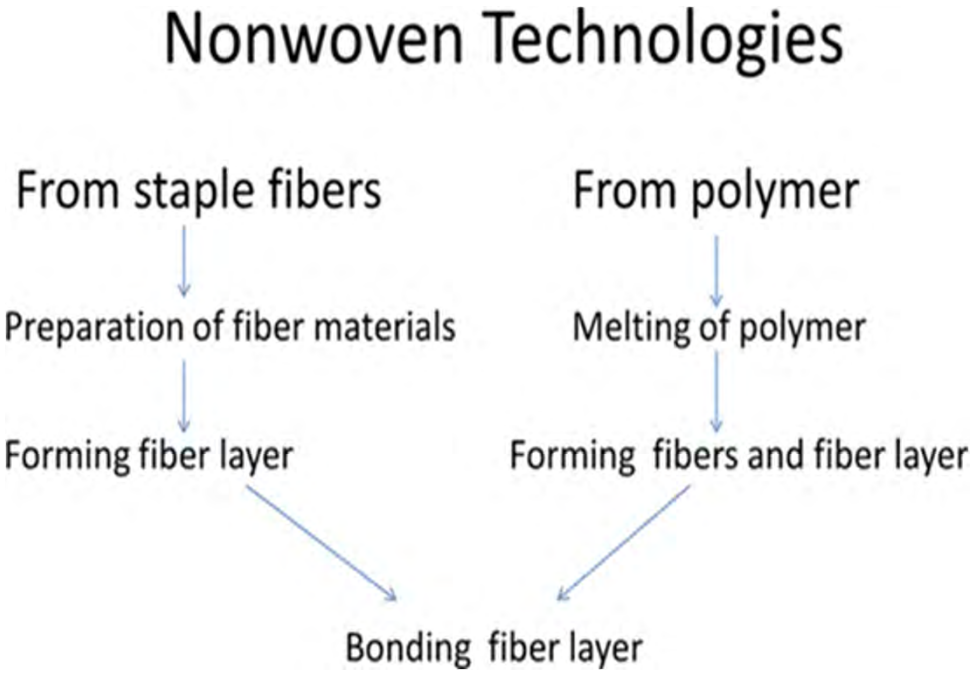
- Breathable
- Absorbent
- Liquid repellent
- Soft, resilient
- Stretchable
- Disposable
- Cushioning
- Filtering
- Bacterial barrier and sterility

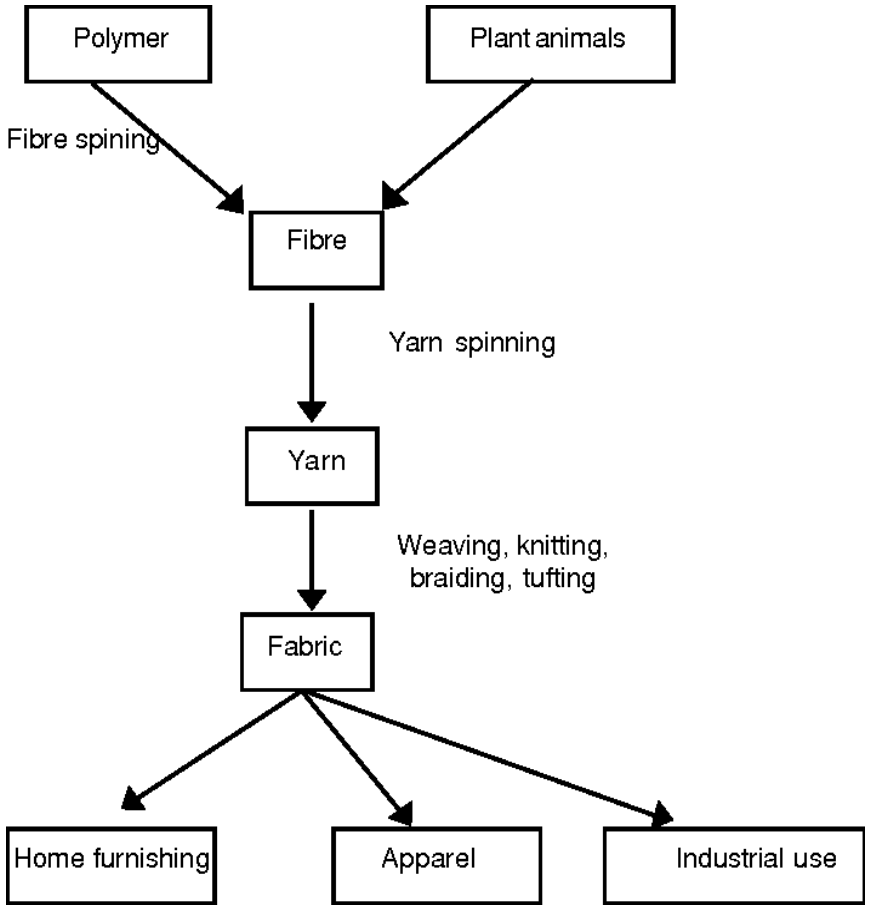


Bringing Convenience, Happiness and Success---Significant



Cost effectiveness of Nonwoven





Cost effectiveness of Nonwoven

Fibre Spinning

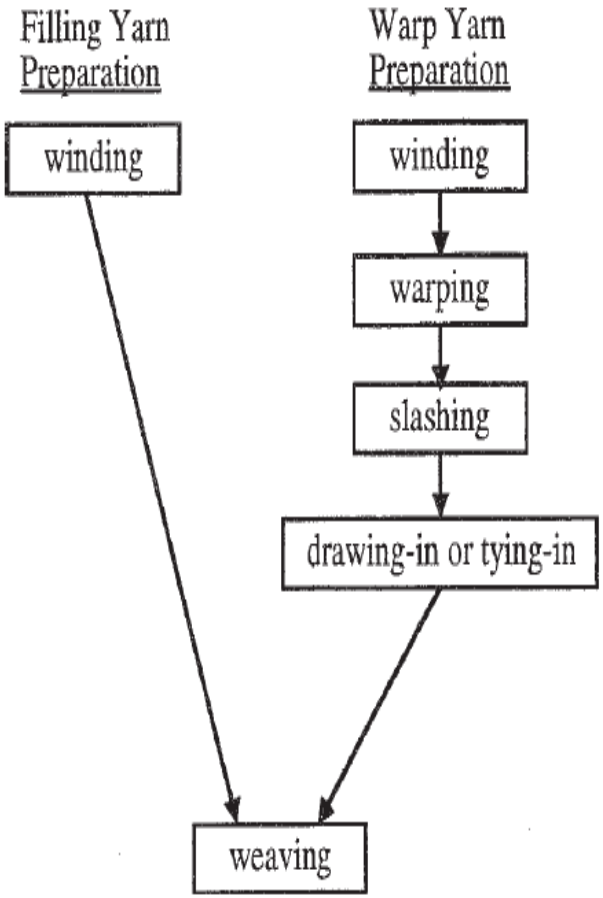
1. • Manufacture of the fiber formi polymer
2. • Spinning
3. • Stretching/ Drawing
4. • Texturisation
5. • Intermingling
6. • Heat setting

Yarn Spinning

Spinning Process Flow

Blending → Carding → Combing → Gilling → Drawing → Roving → Spinning → Winding → Assembly Winding → Twisting → Steaming

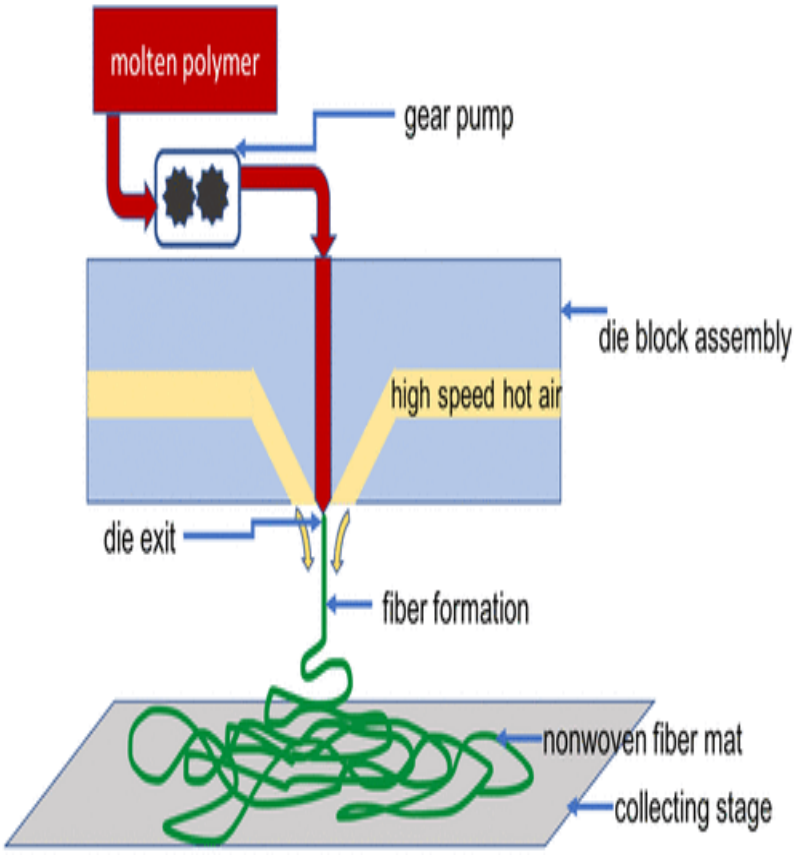
Weaving Preparation

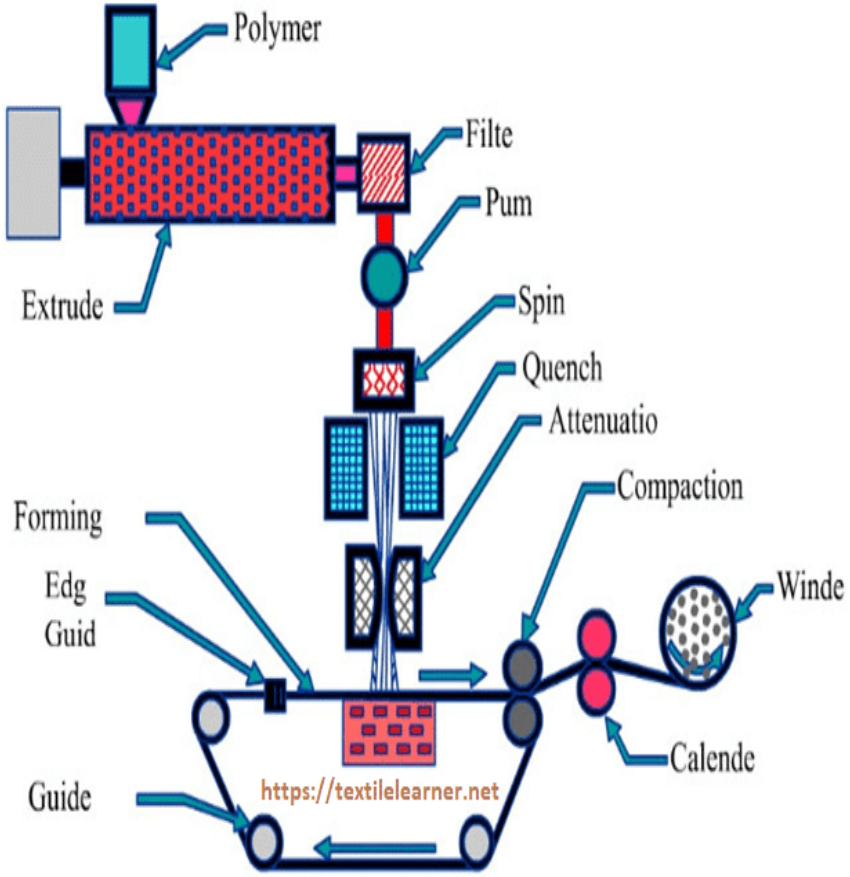


Non-woven: from Polymer to Fabrics

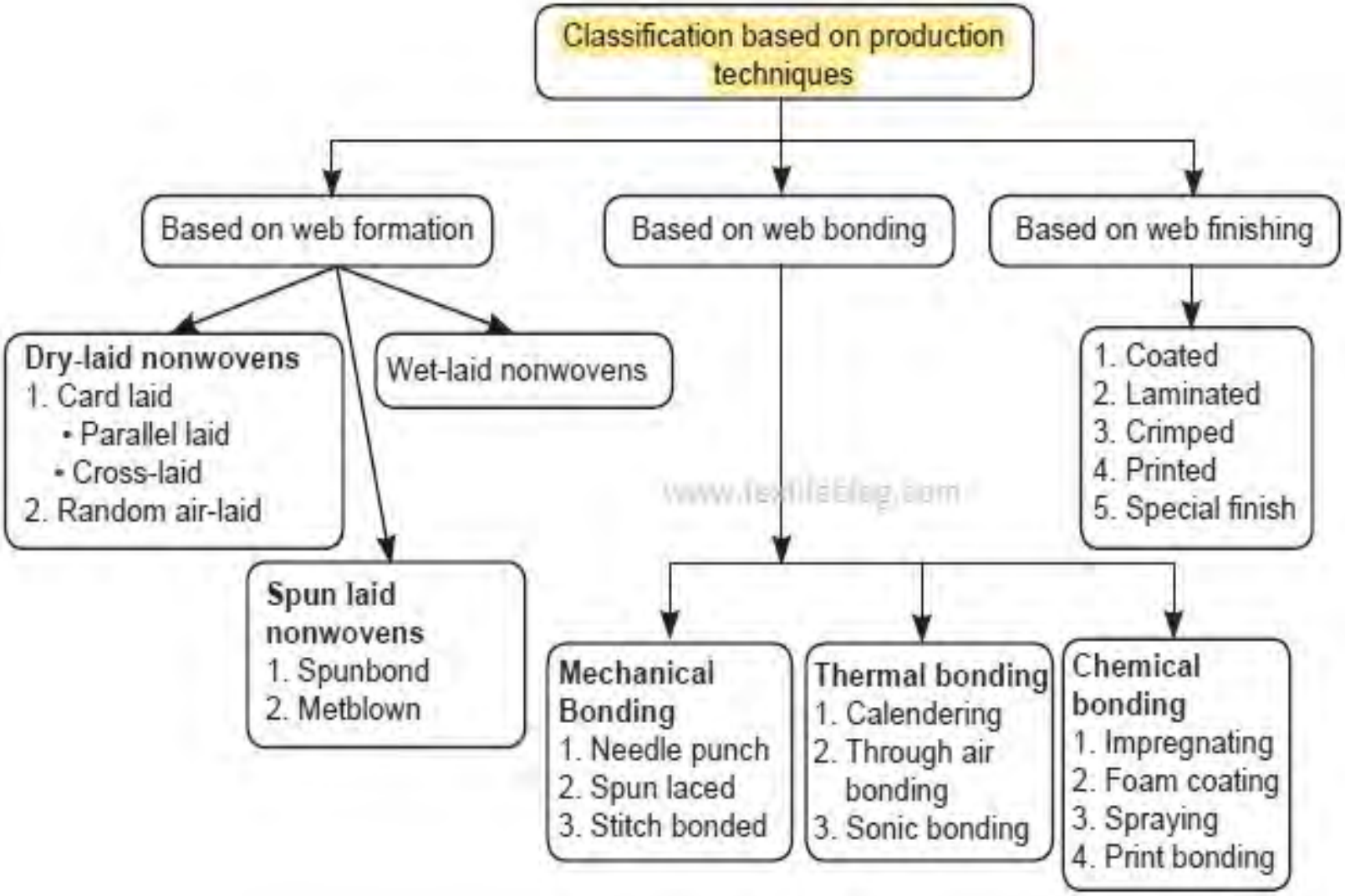
Process is so short and the speed is very high

SS: Production speed up to 450 m/min





Versatility of NonWoven Technologies



History of Nonwovens

1920s-1930s

Chicopee Manufacturing Corp developed Viscose rayon Products, for hygiene uses.

Freudenberg and DuPont developed enhancing technology in spunbond

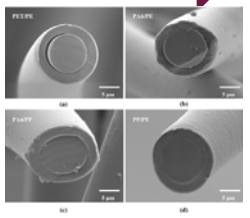
1950s

1970s

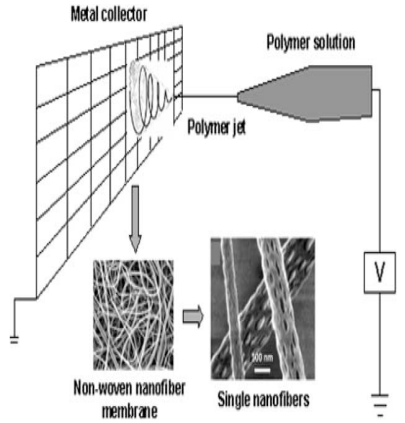
Water-jet technology was developed for surgical gauze

Bicomponent fibers were developed in meltblown and spunbonded nonwovens

1990s

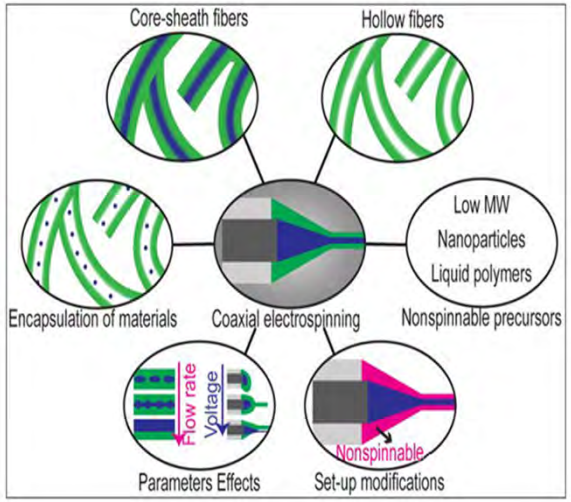


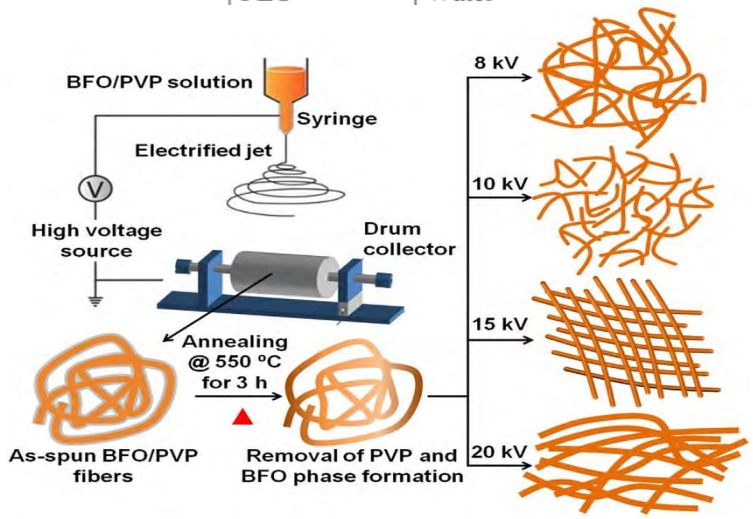
Electrospinning

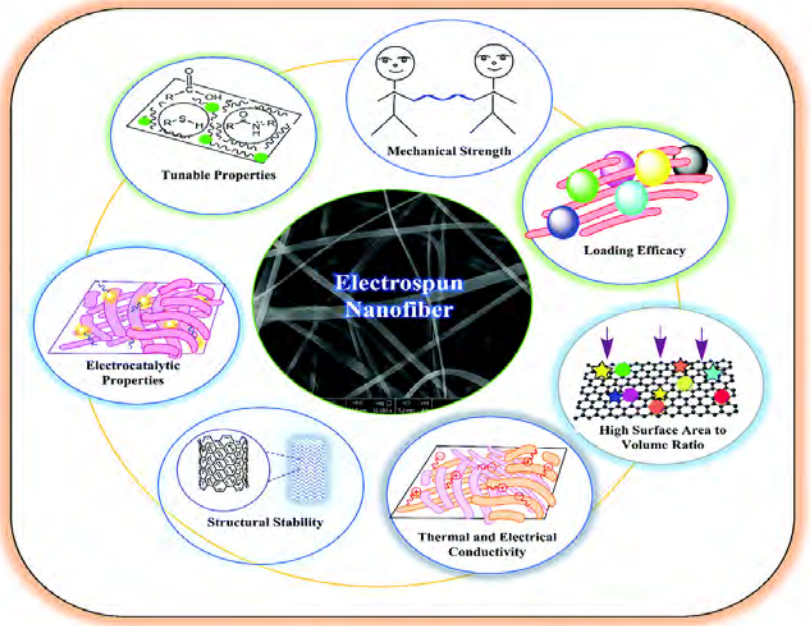


Versatility of Electrospun NonWoven

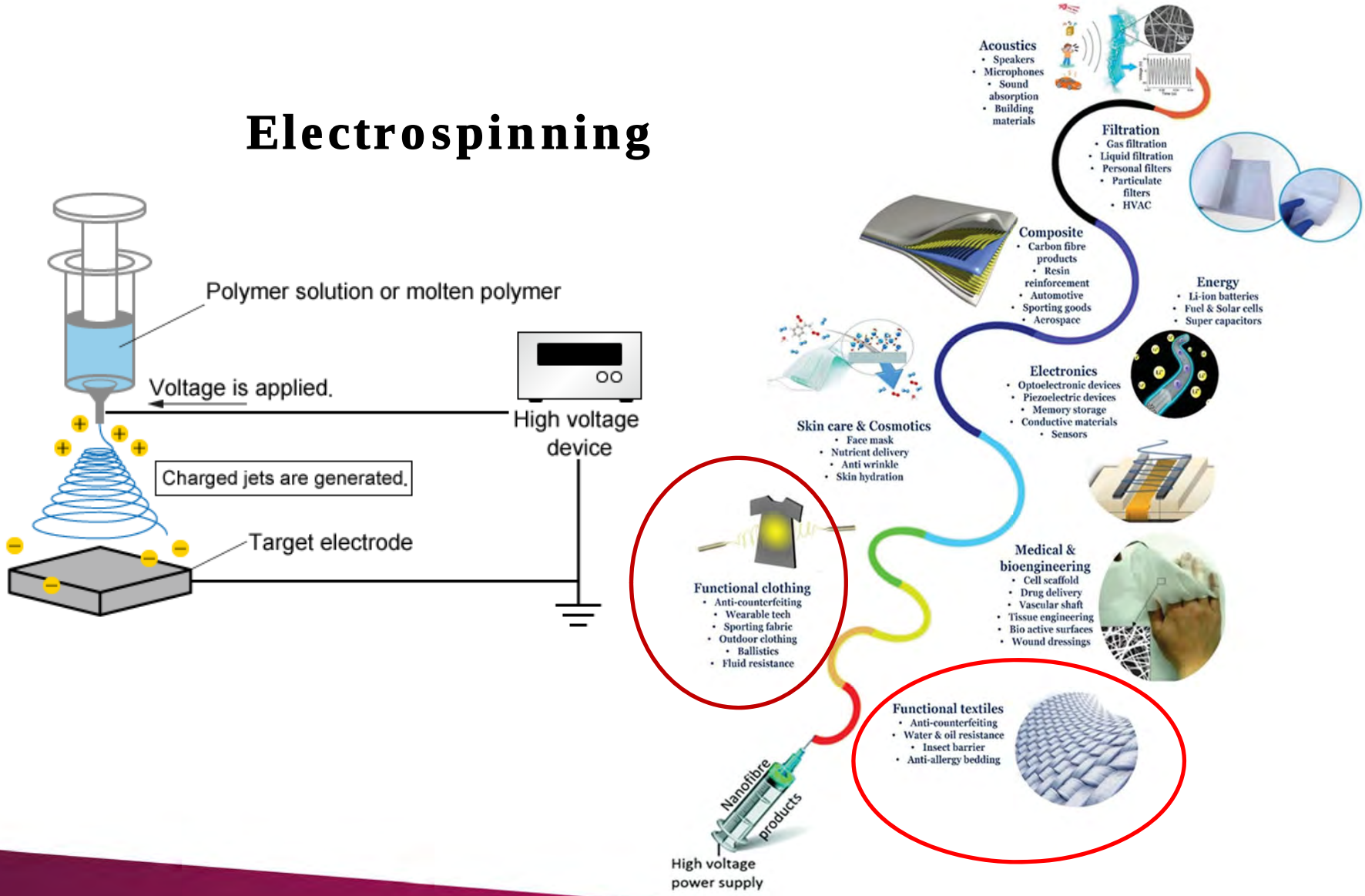
Type of polymer	Polymer	Solvent
	Silk fibroin	Formic acid
Natural polymers	Chitosan	Trifluoroacetic acid(TFA)
	Gelatin	Acetic acid
	Collagen	Hexafluoroisopropanol (HFIP)
	Fibrinogen	HFIP/10 × minimal essential medium
Synthetic polymers	PCL	Chloroform/dimethylformamide (DMF
	PLA	Dichloromethane (DCM)
	PVA	Water
	PVP	Methanol
	PAN	DMF
	Nylon-6	Formic acid
	PET	TFA/DCM
	PU	DMF
	PI	N,N-dimethylace tamide (DMAc)
	EVOH	80 % propan-2-ol/Water
	CA	Acetic acid/Water
	PGA	Water
	PEO	Water







Electrospinning and Applications

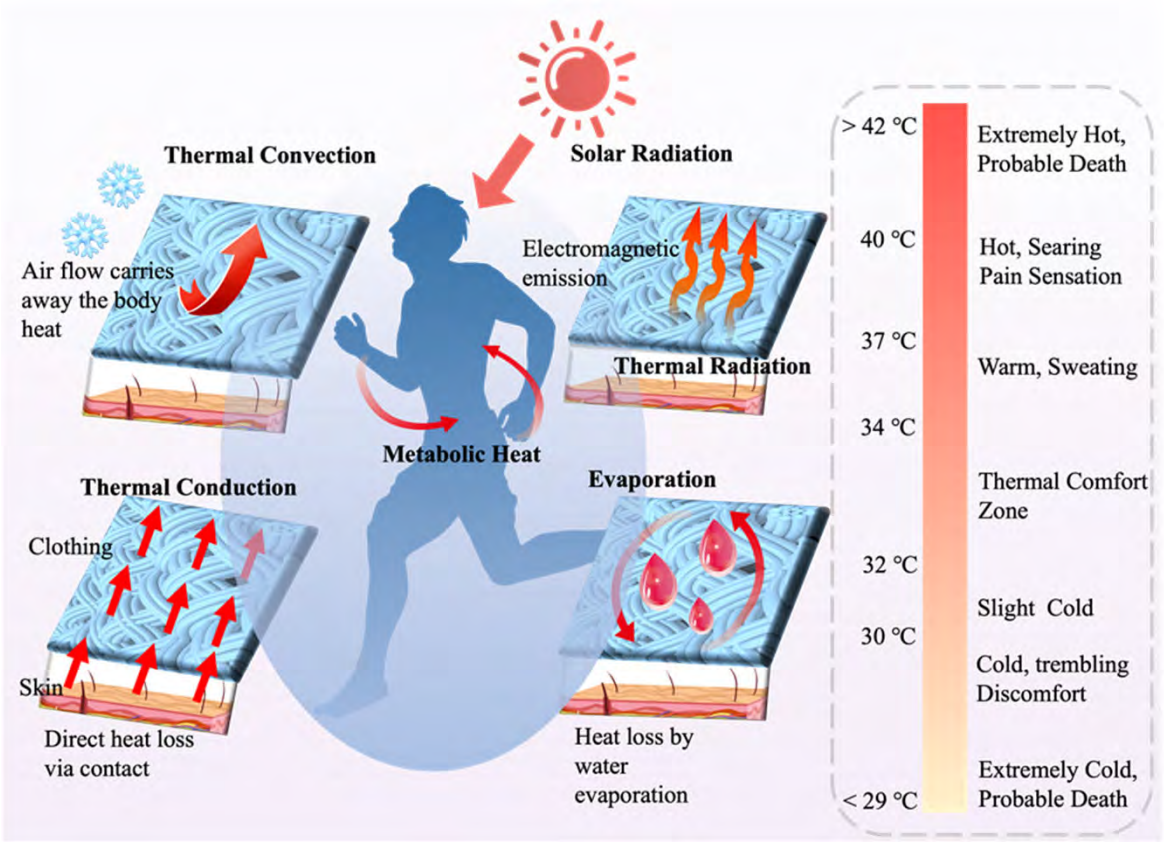


Advanced Functional Nonwovens in Textiles and Apparel

- Thermoregulatory textiles
- Wearable Sensing Devices
- Functional Filtration Systems
- Protective Clothing
- Hygiene and Biomedical Textiles

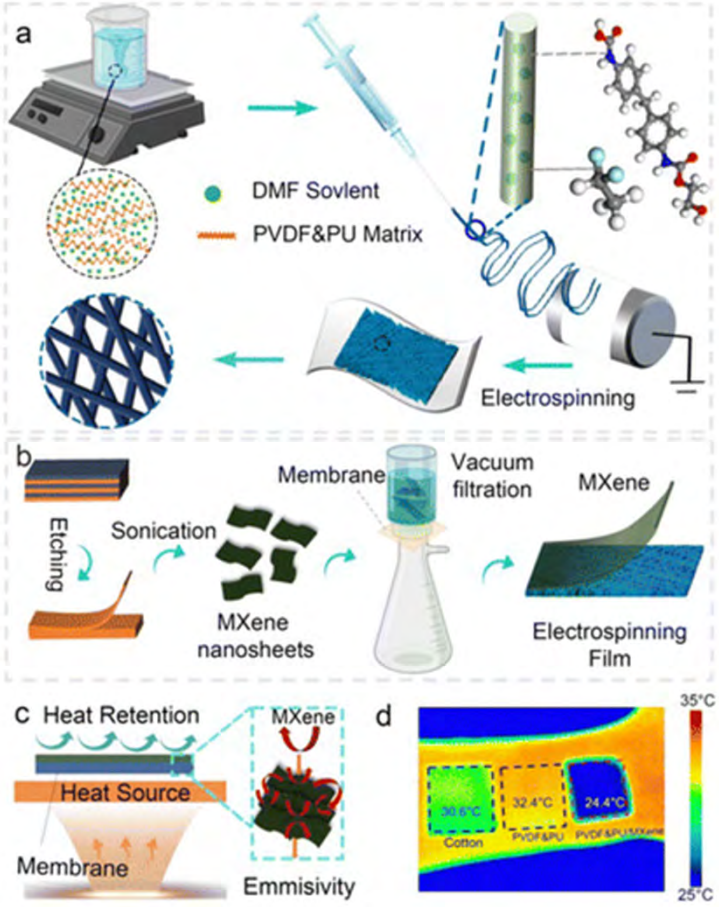
Thermoregulatory Textiles

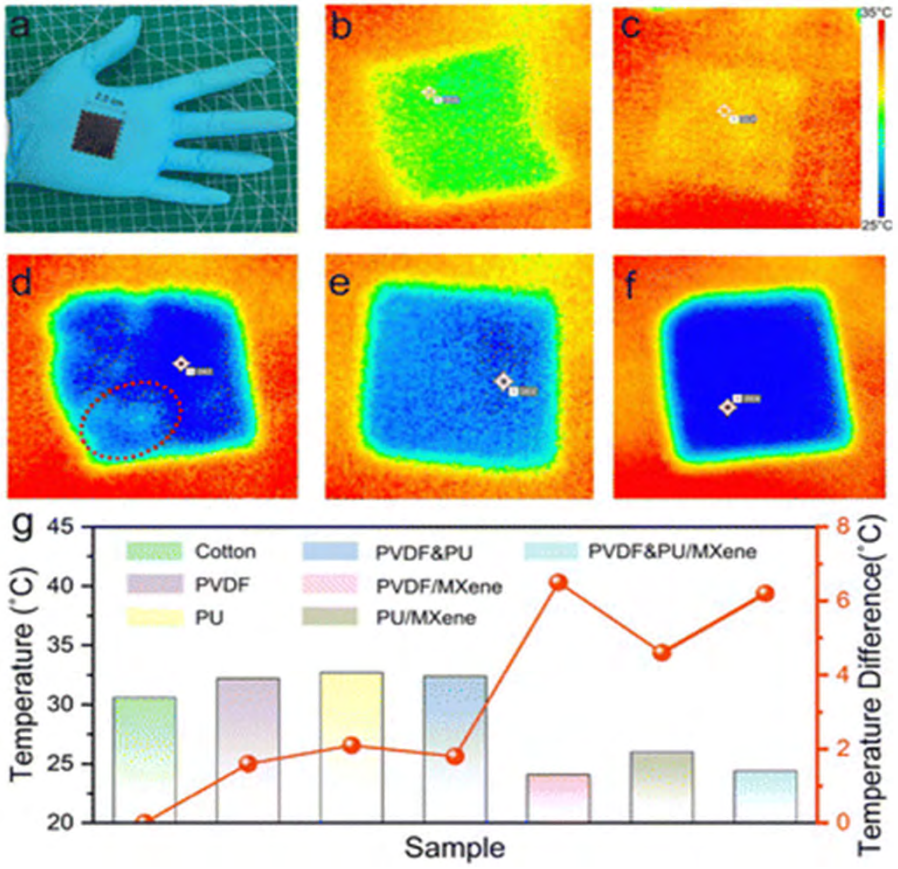
Body Heat: Input, Output and Pphysiological Responses



Heat transfer pathway between the human body and outer environment as well as adverse physiological responses to variations in core body temperature; Metabolic heat and solar absorption are two heat input mechanisms. Output channels include conduction, convection, radiation, and evaporation.

Low-emissivity passive heating membrane with warmth retention for Thermoregulatory textiles-Warming

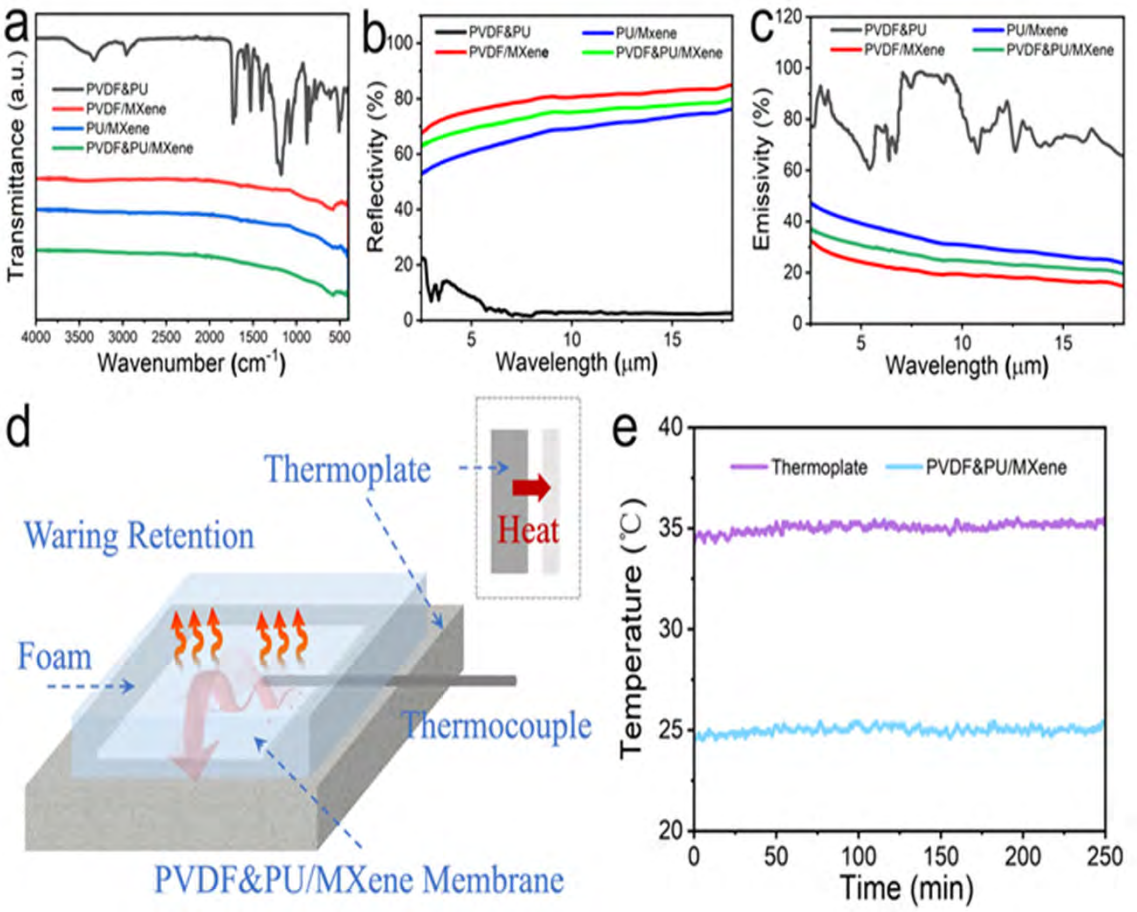




A supramolecular-enhanced membrane (SupraEM) acting as a mid-infrared (MIR) reflector to solve the conundrum of warmth-wearability performance.

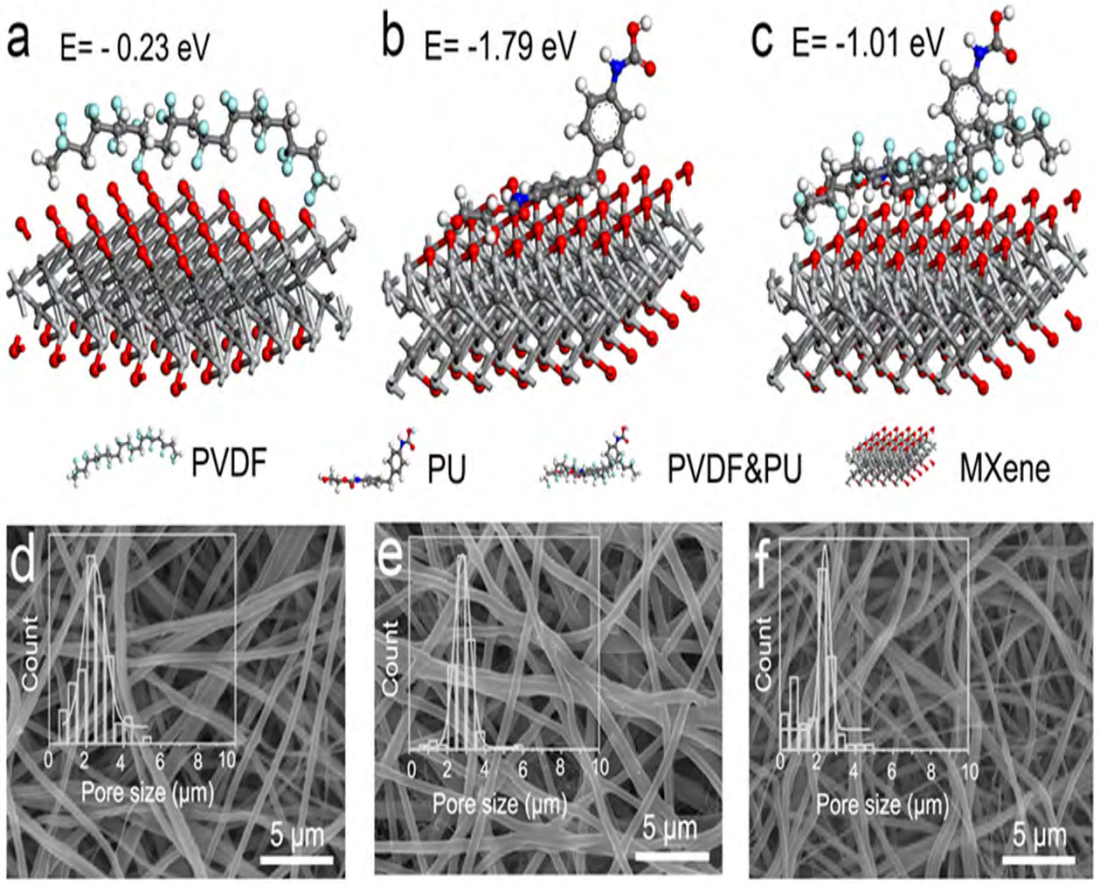
https://doi.org/10.1039/D3MH00768E

Infrared spectroscopy Spectra



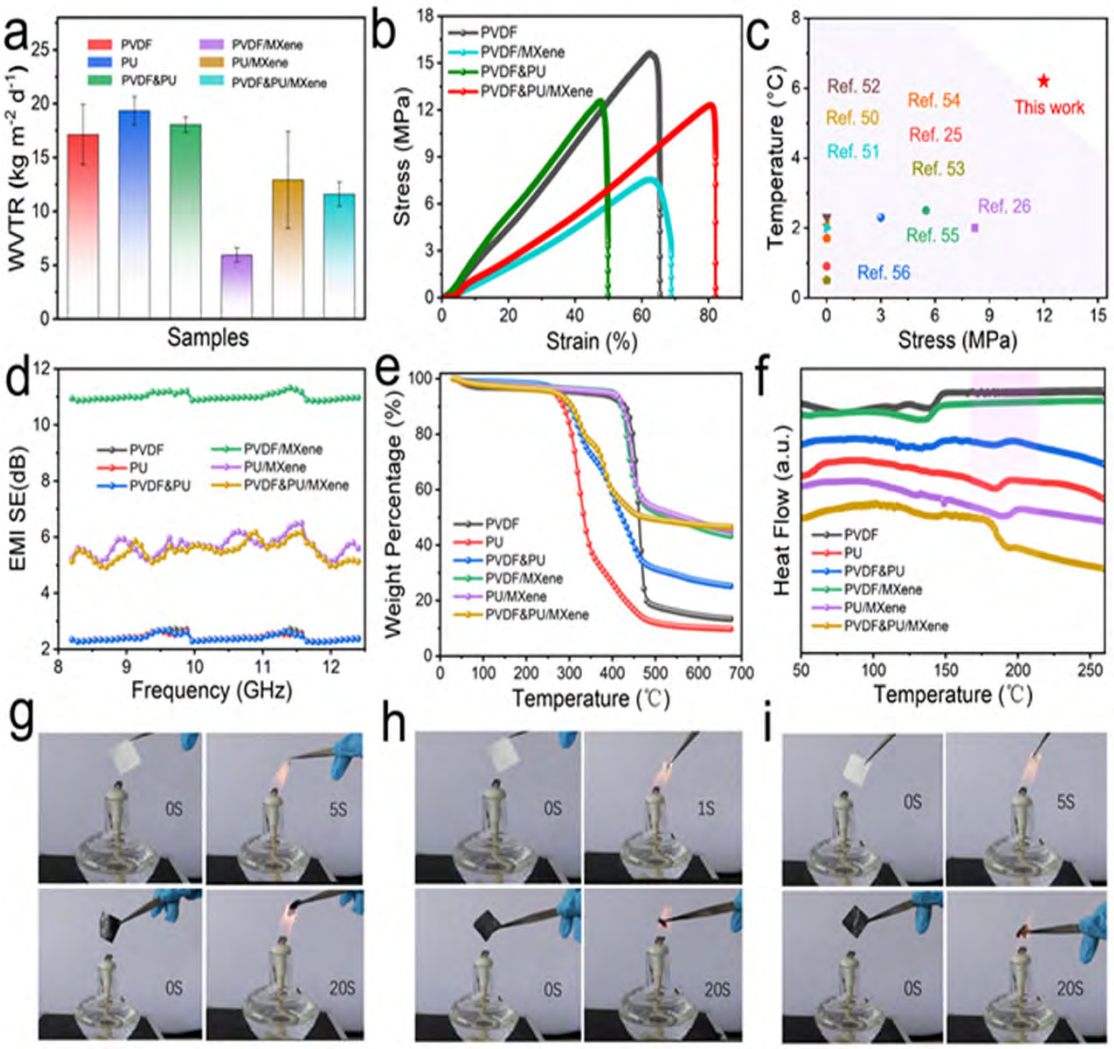
(b) Reflectivity, and
(c) Emissivity of PVDF&PU, PVDF/MXene, PU/MXene, and PVDF&PU/MXene.
(d) Schematic diagram of the heating platform experiment, with the heat transfer direction.
(e) Real-time temperature record of PVDF&PU/MXene at 35 °C.

Mechanism of SUPRAEMs



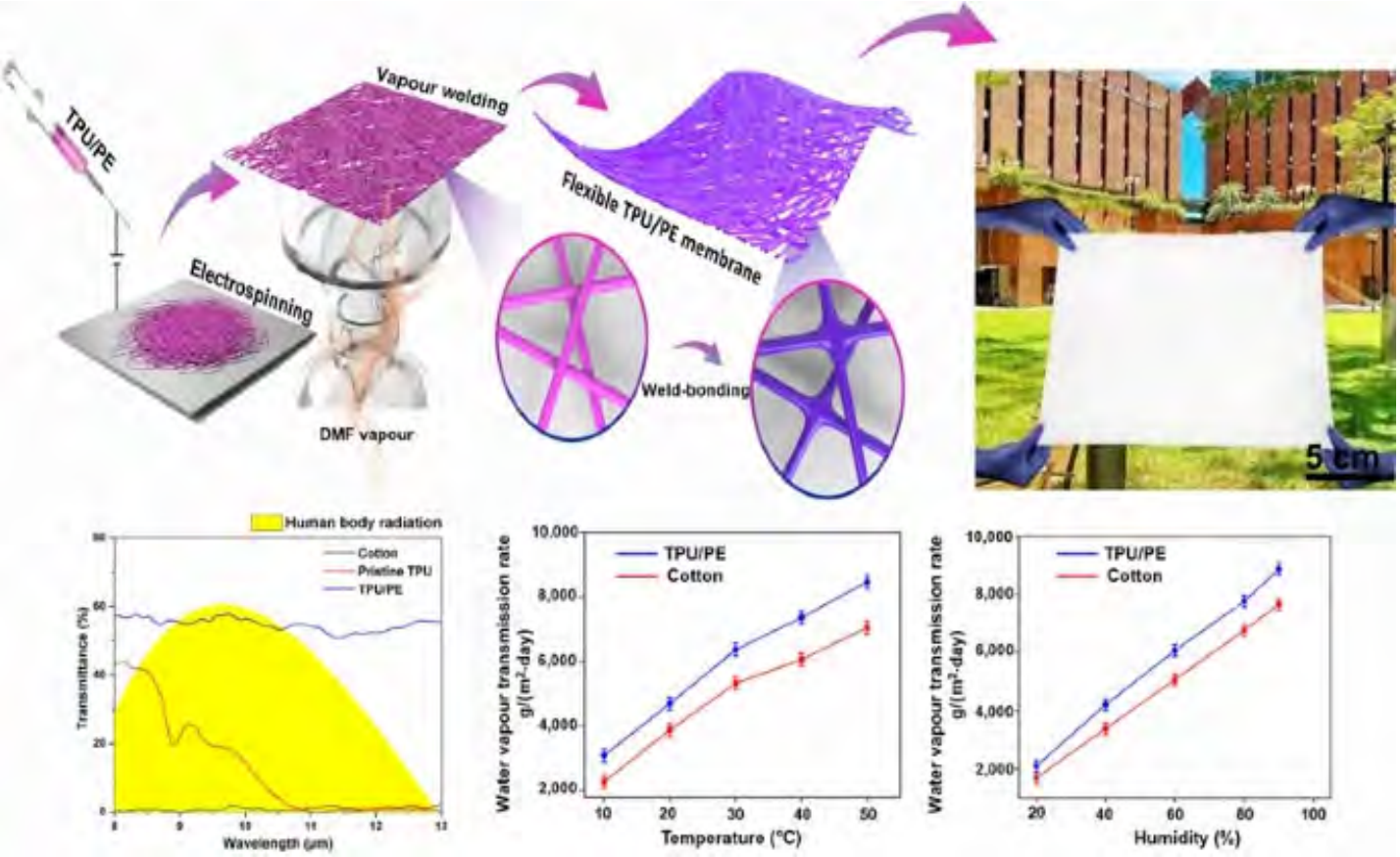
The optimized configurations of (a) PVDF/MXene, (b)PU/MXene, and (c) PVDF&PU/MXene during the process of mutual absorption. SEM images and insert pore size distribution of polymers (d) PVDF, (e) PU, and (f) PVDF&PU.

Performances of SupraEMs



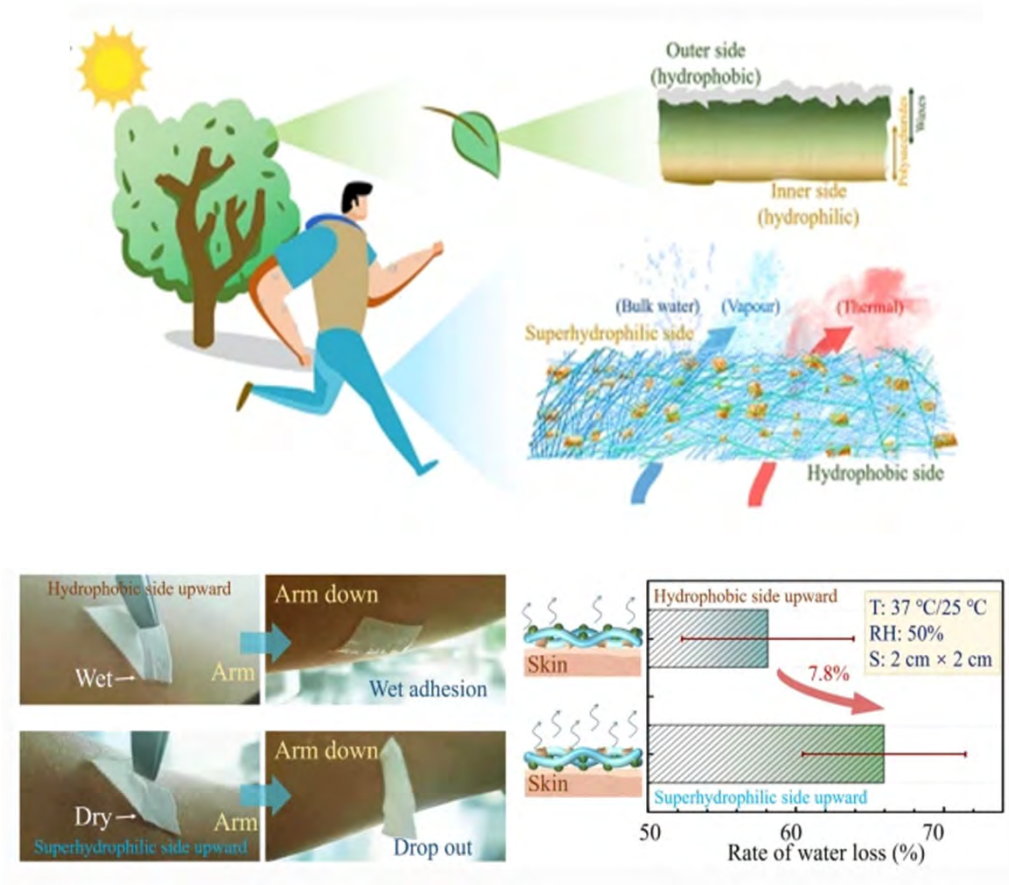
(a) Water vapor transmission rate
(b) Strain-stress curves
(c) Comparison of the maximum temperature difference and maximum withstanding strength with other reported studies.
(d) EMI curves.
(e) TGA curves
(f) DSC curves. Photograph of the combustion process
(g) PVDF and (PVDF/MXene,
(h) PU and PU/Mxene
(i) PVDF&PU and PVDF&PU/MXene.

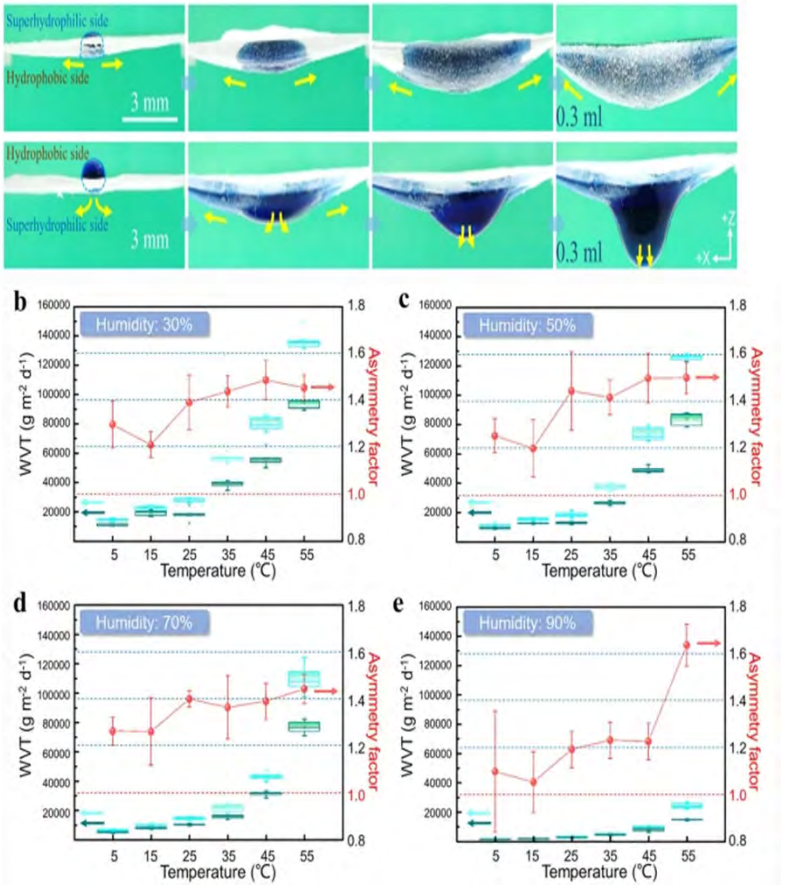
Evaporative/radiative electrospun membrane for personal cooling



Thermoregulatory textiles：

Single-Layer Janus Fabric with Directional Water Transport for Integrated Personal Cooling Management



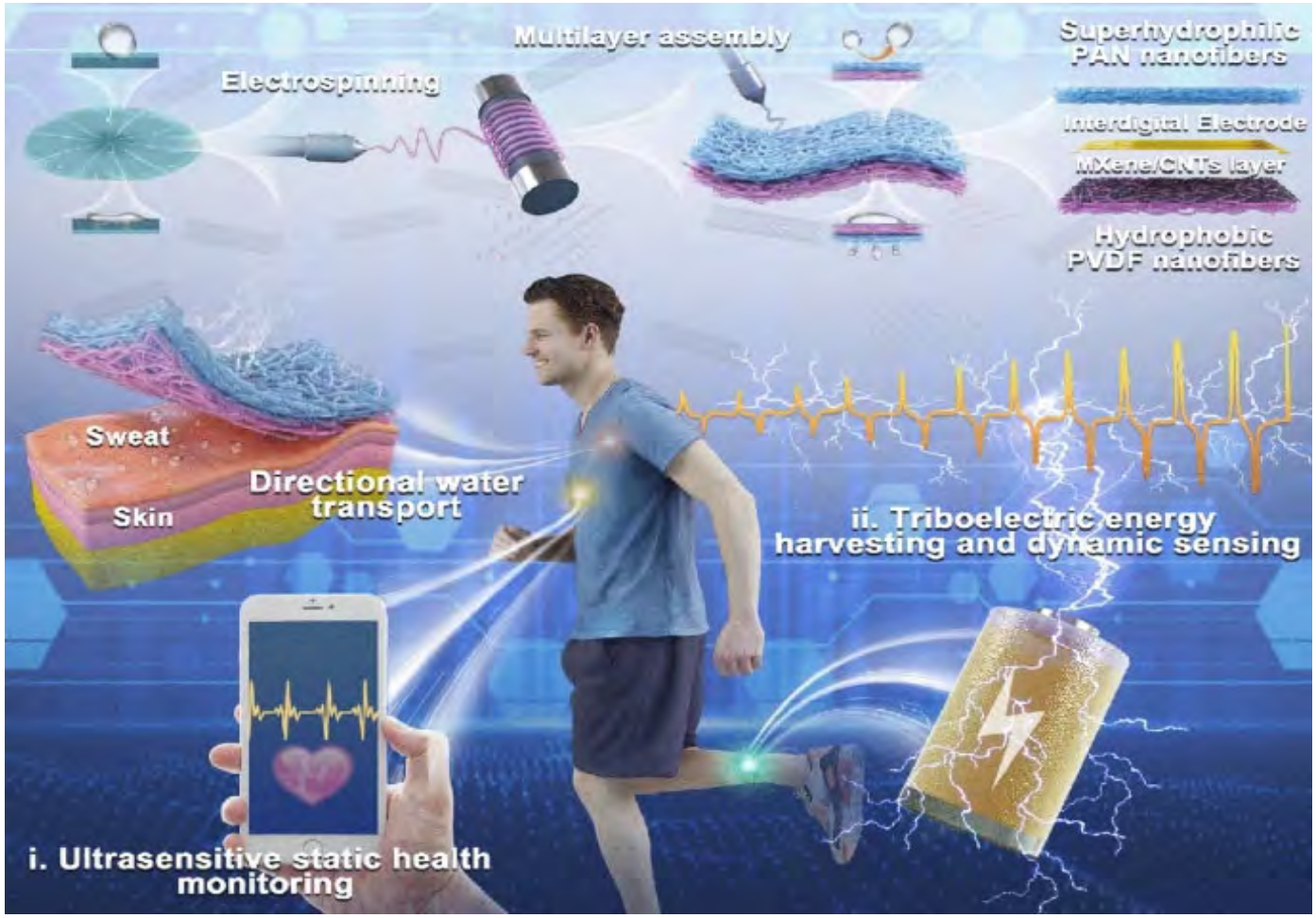


A Janus Nonwovens for directional water transport property and cooling management

10.1007/s42765-022-00200-4

Wearable Electronics

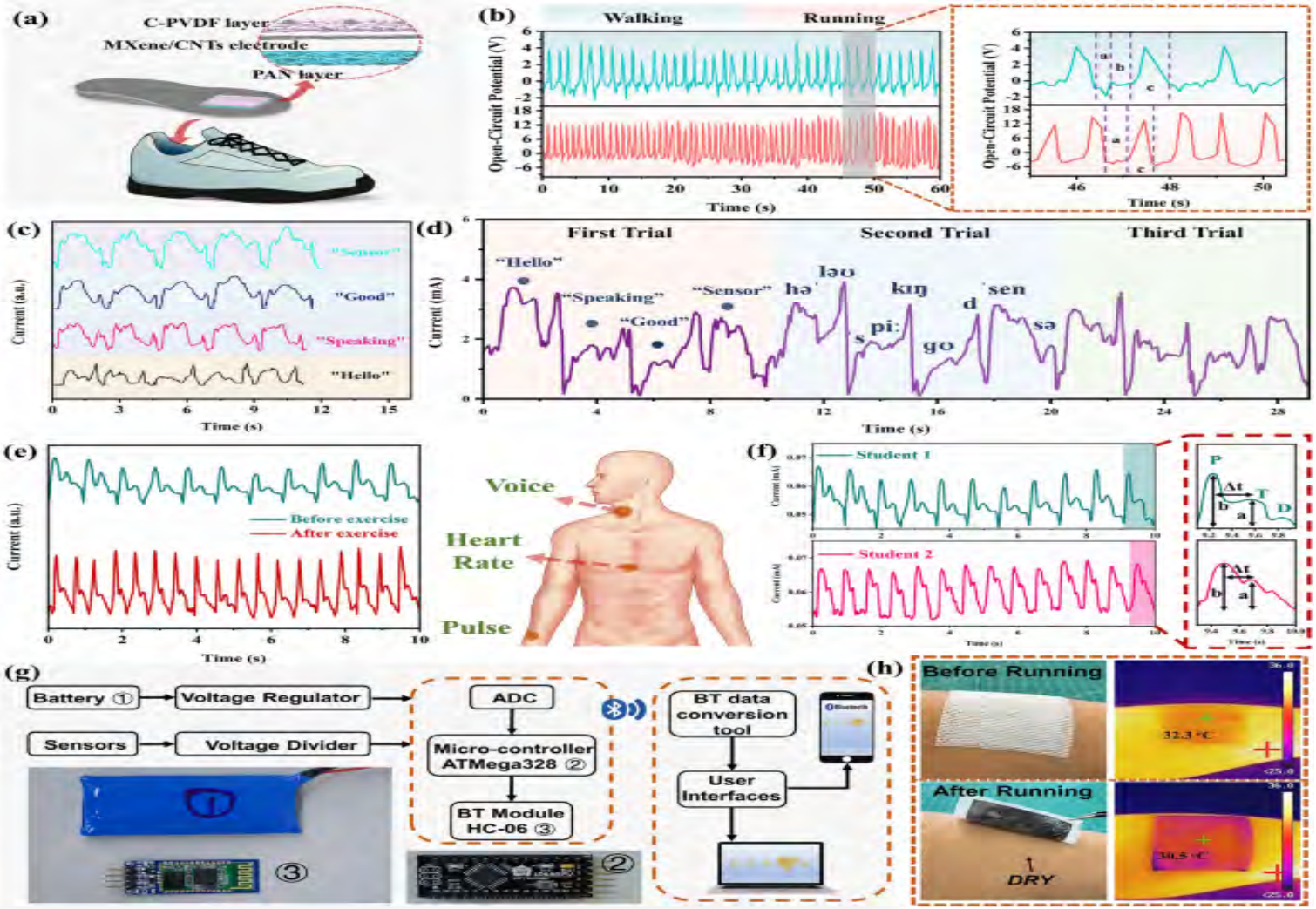
Directional Moisture-Wicking Electronic Skins for Biomechanical Energy Harvesting and All-Range Health Sensing



Wearable devices developed from PVDF electrospun nonwovens, integrating moisture-wicking effect and static signal sensing. It can monitor walking, speaking, pulsing.

10.1007/s40820-023-01028-2

Directional Moisture-Wicking Electronic Skins for Biomechanical Energy Harvesting and All-Range Health Sensing



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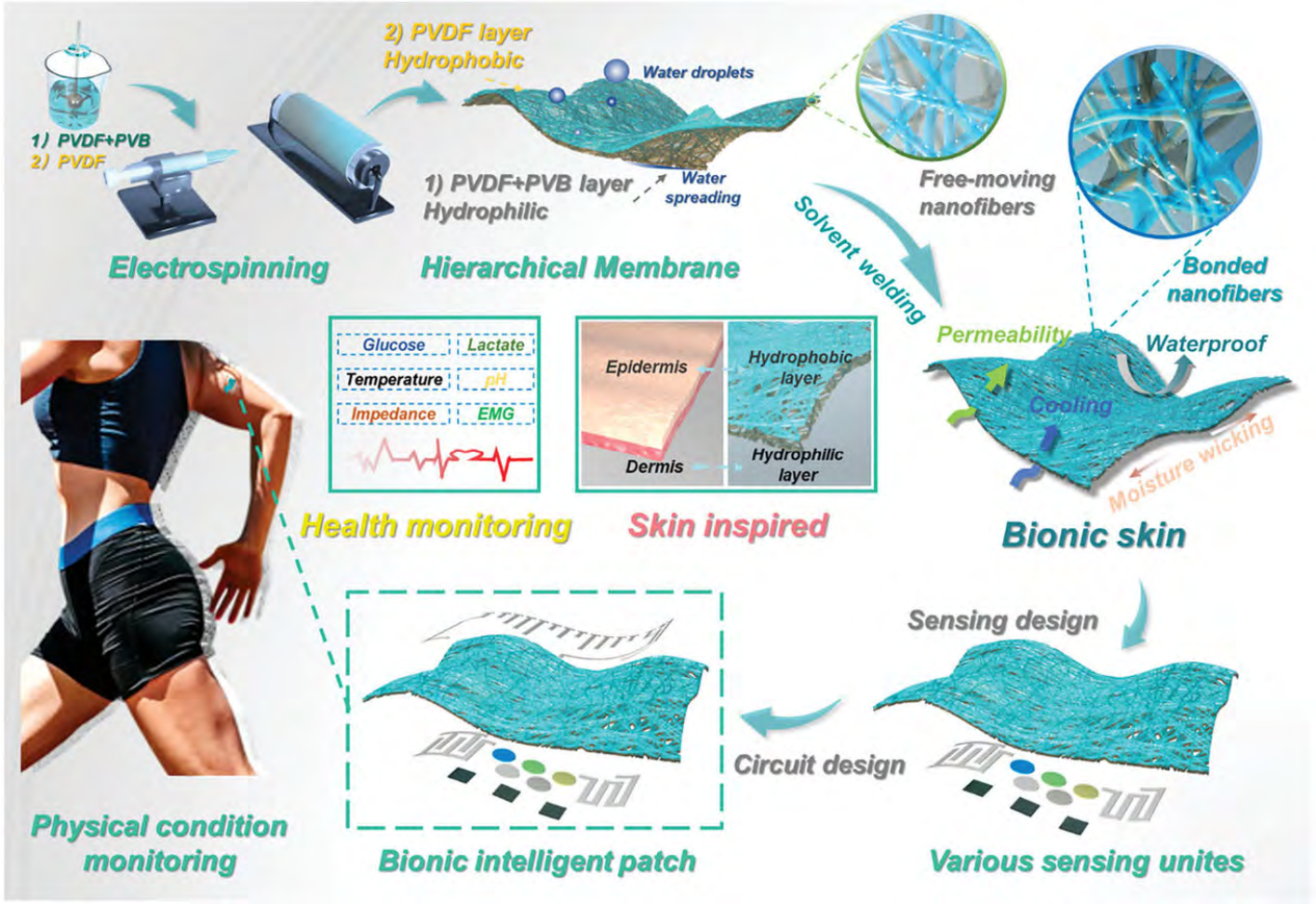
A Bionic Skin for Health Management
Excellent Breathability, In Situ Sensing, and Big Data Analysis



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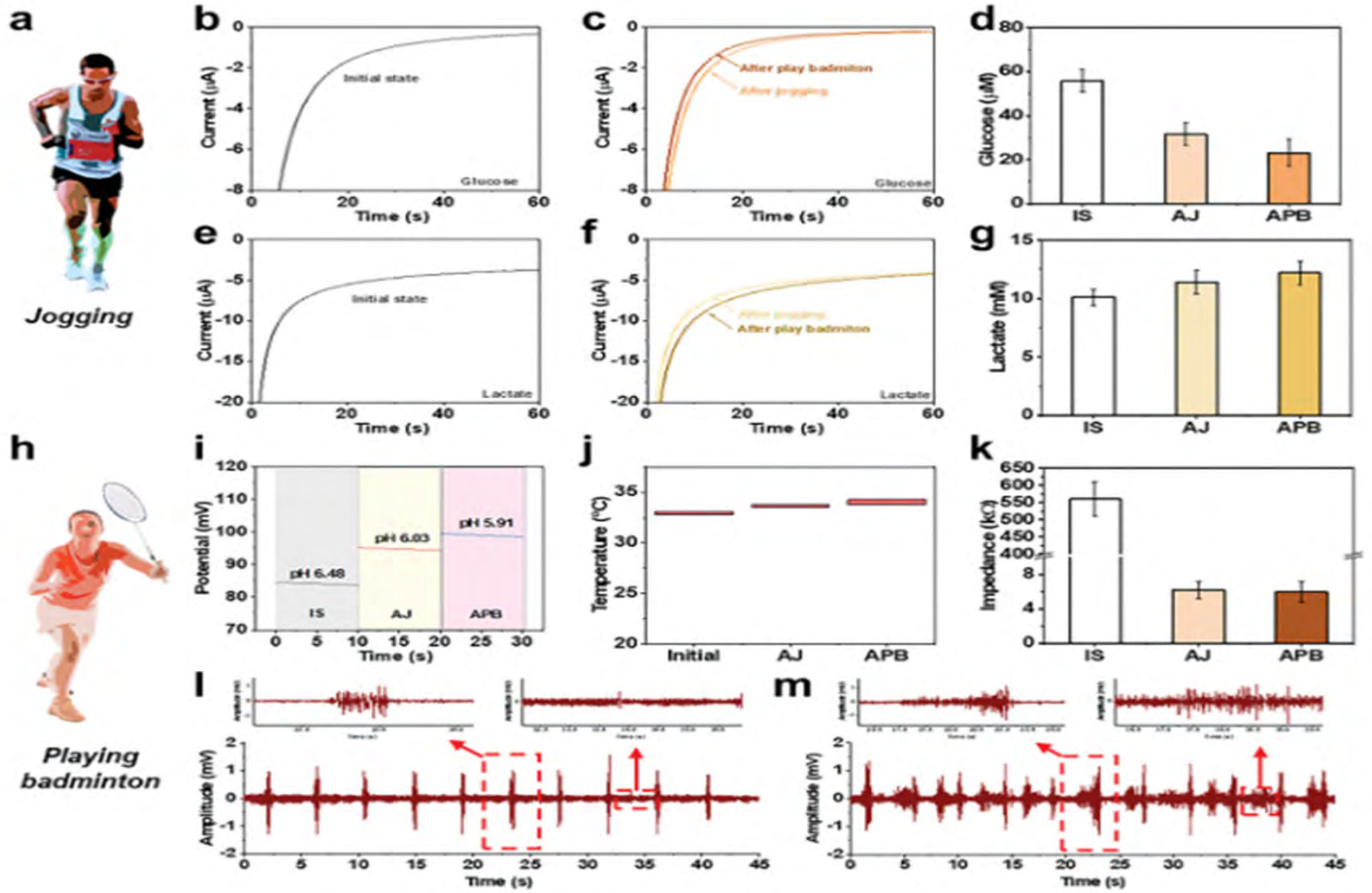

Wearable devices developed from PVDF electropunk nonwovens, integrating moisture-wicking effect and static signal sensing. It can monitor walking, speaking, pulsing.

https://doi.org/10.1002/adma.202306435

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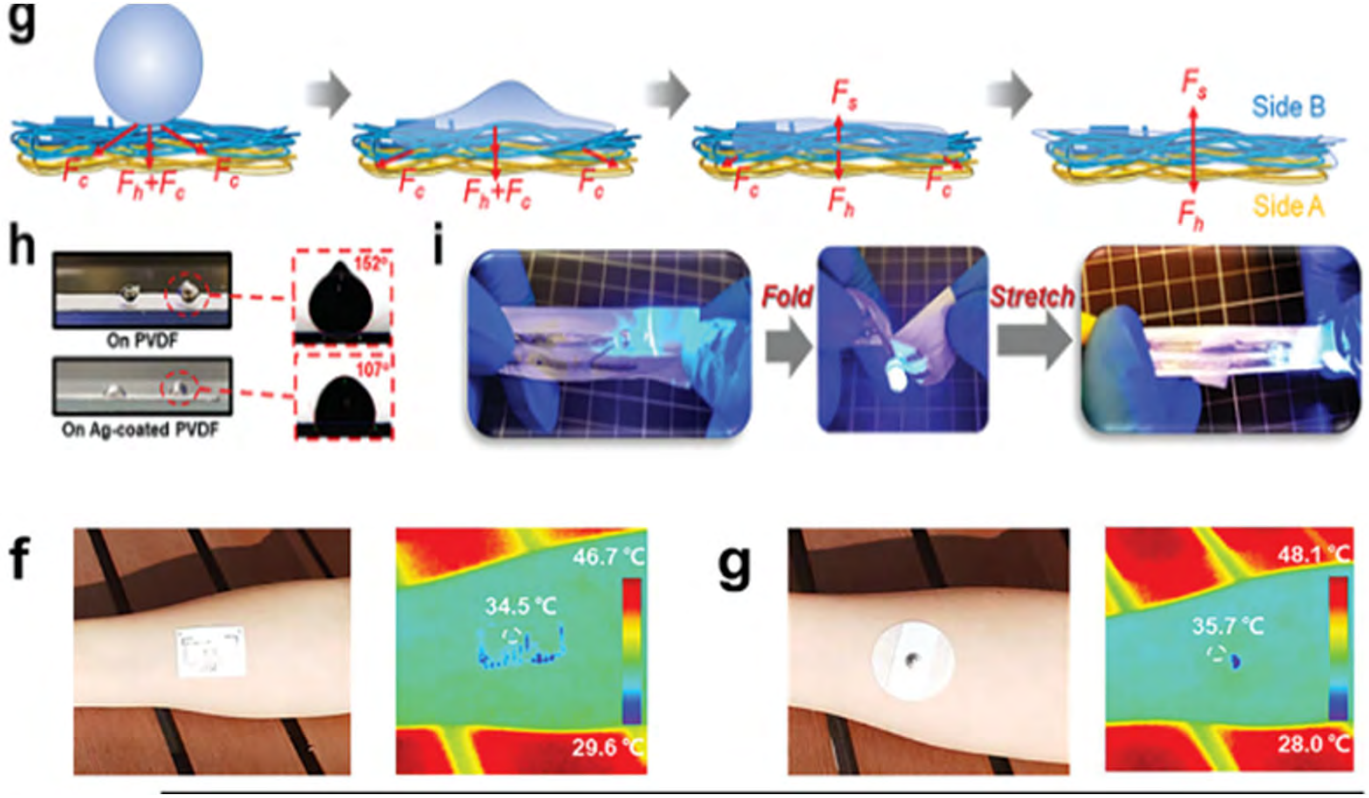

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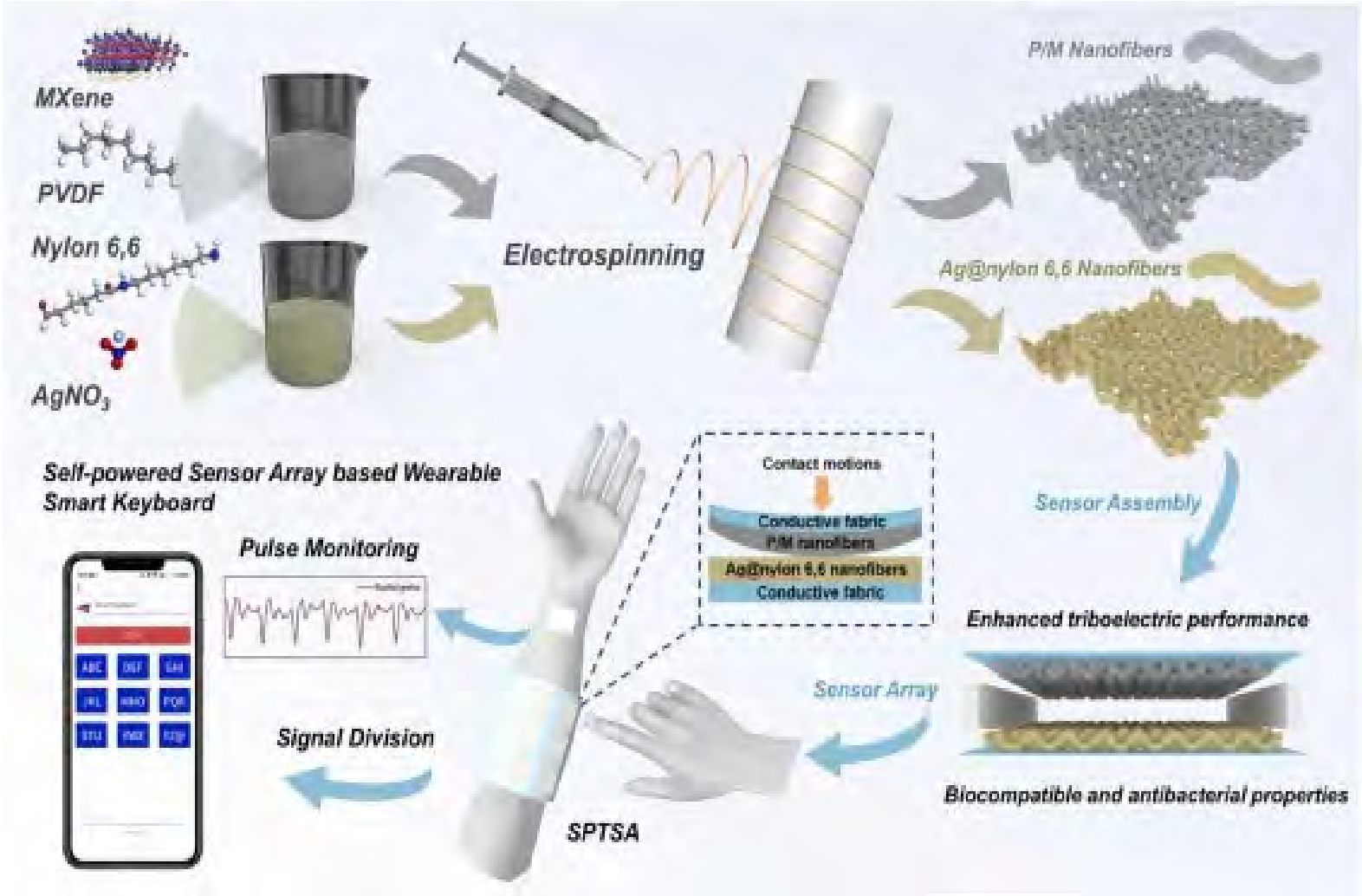
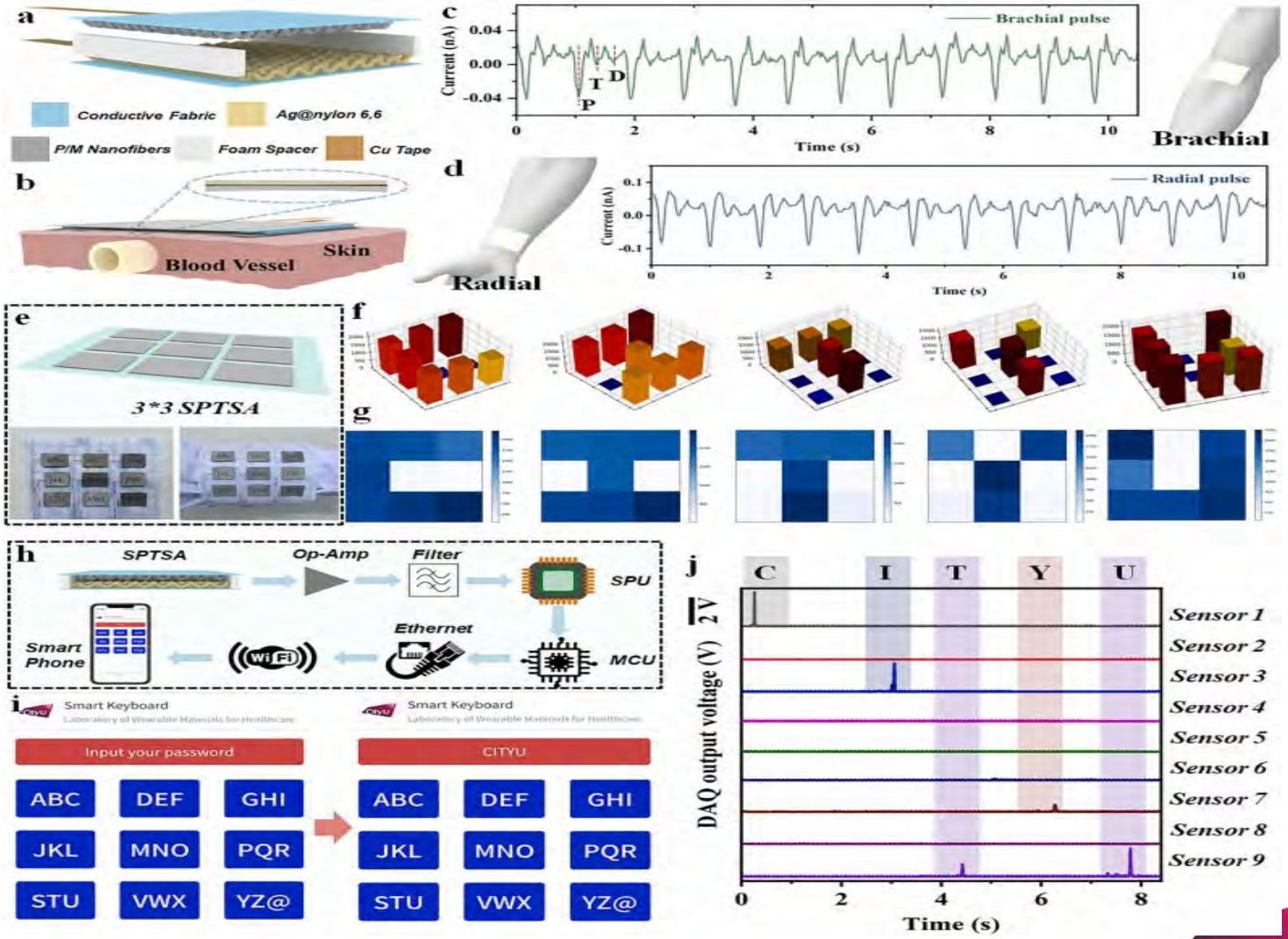
A biocompatible and antibacterial all-textile structured triboelectric nanogenerator for self-powered tactile sensing



Anti-bacterial and self-powering nonwovens

https://doi.org/10.1016/j.nanoen.2023.108734

A biocompatible and antibacterial all-textile structured triboelectric nanogenerator for self-powered tactile sensing



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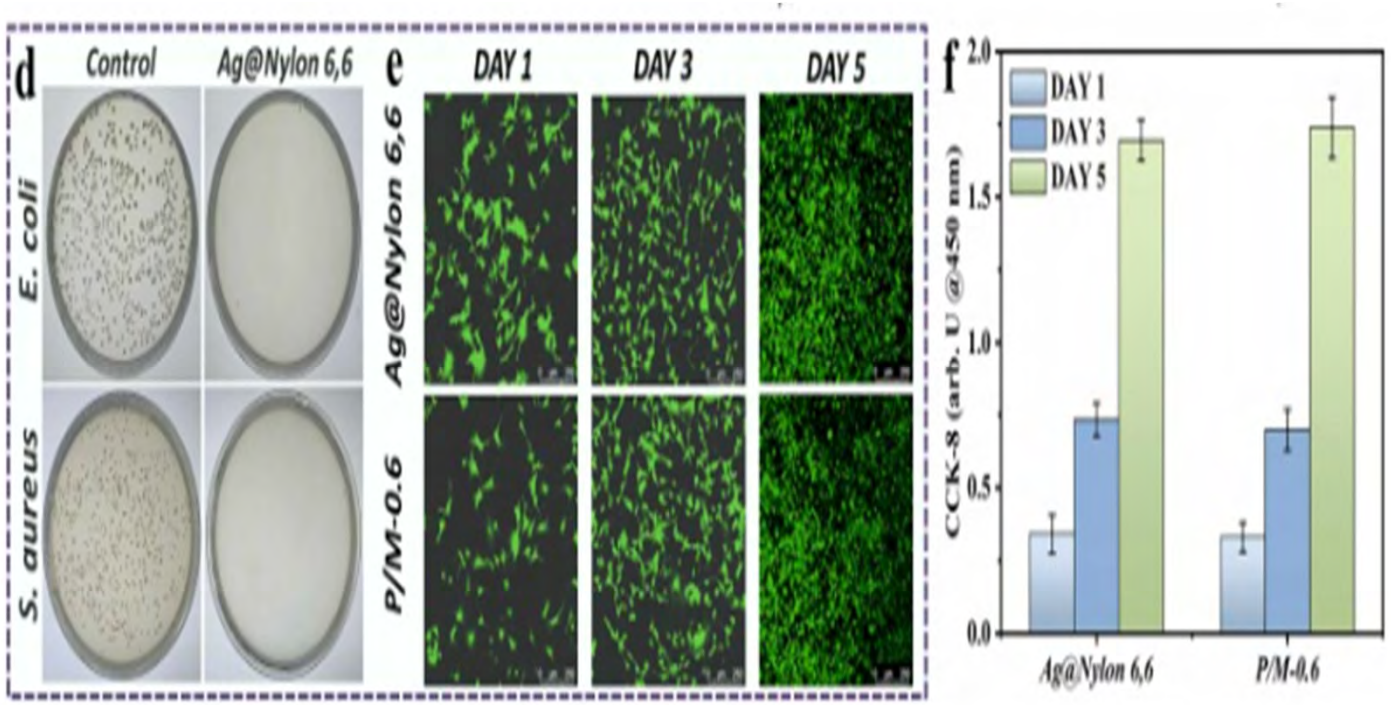

Anti-bacterial and self-powering nonwovens

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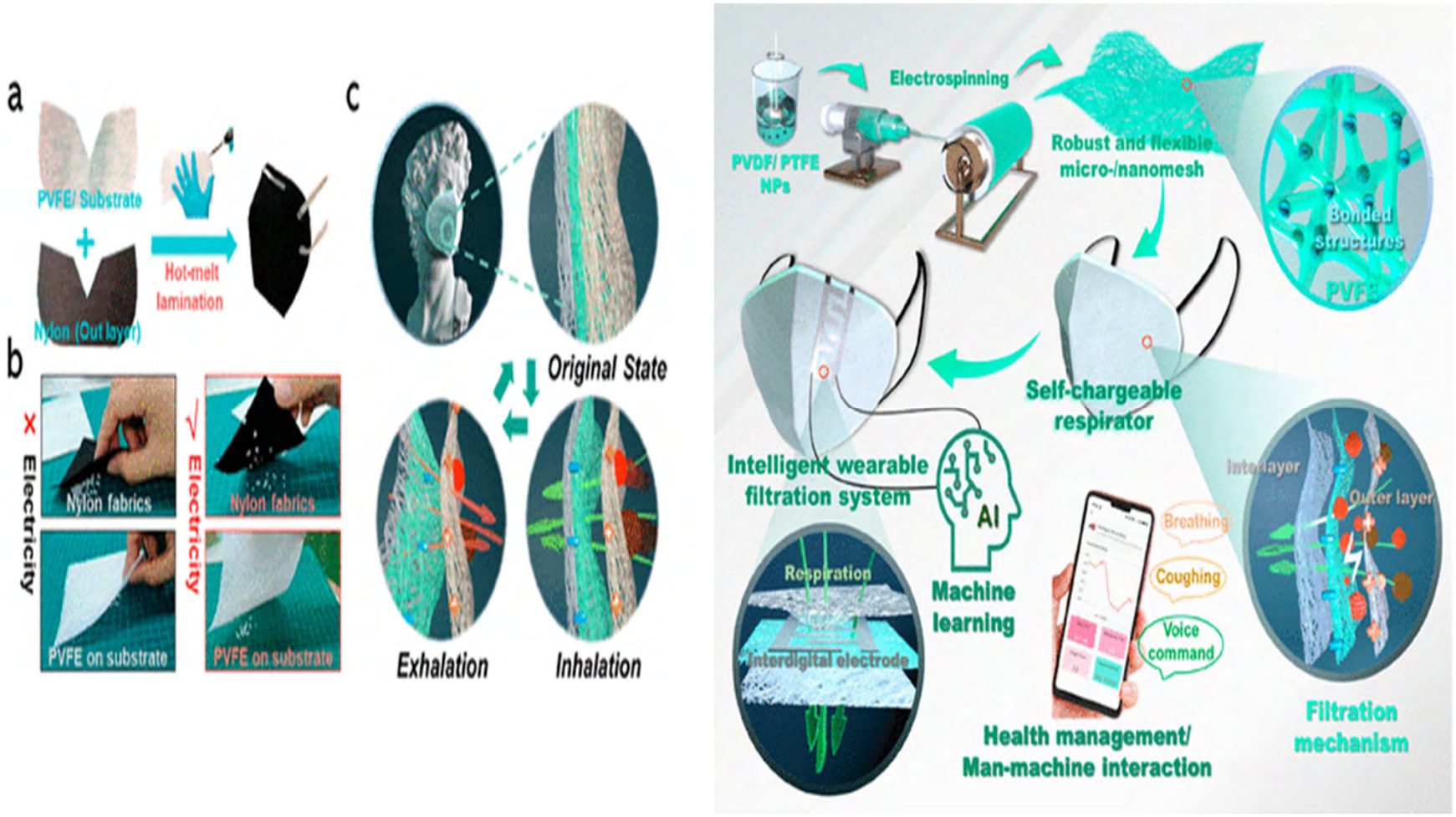
Functional Filtration System

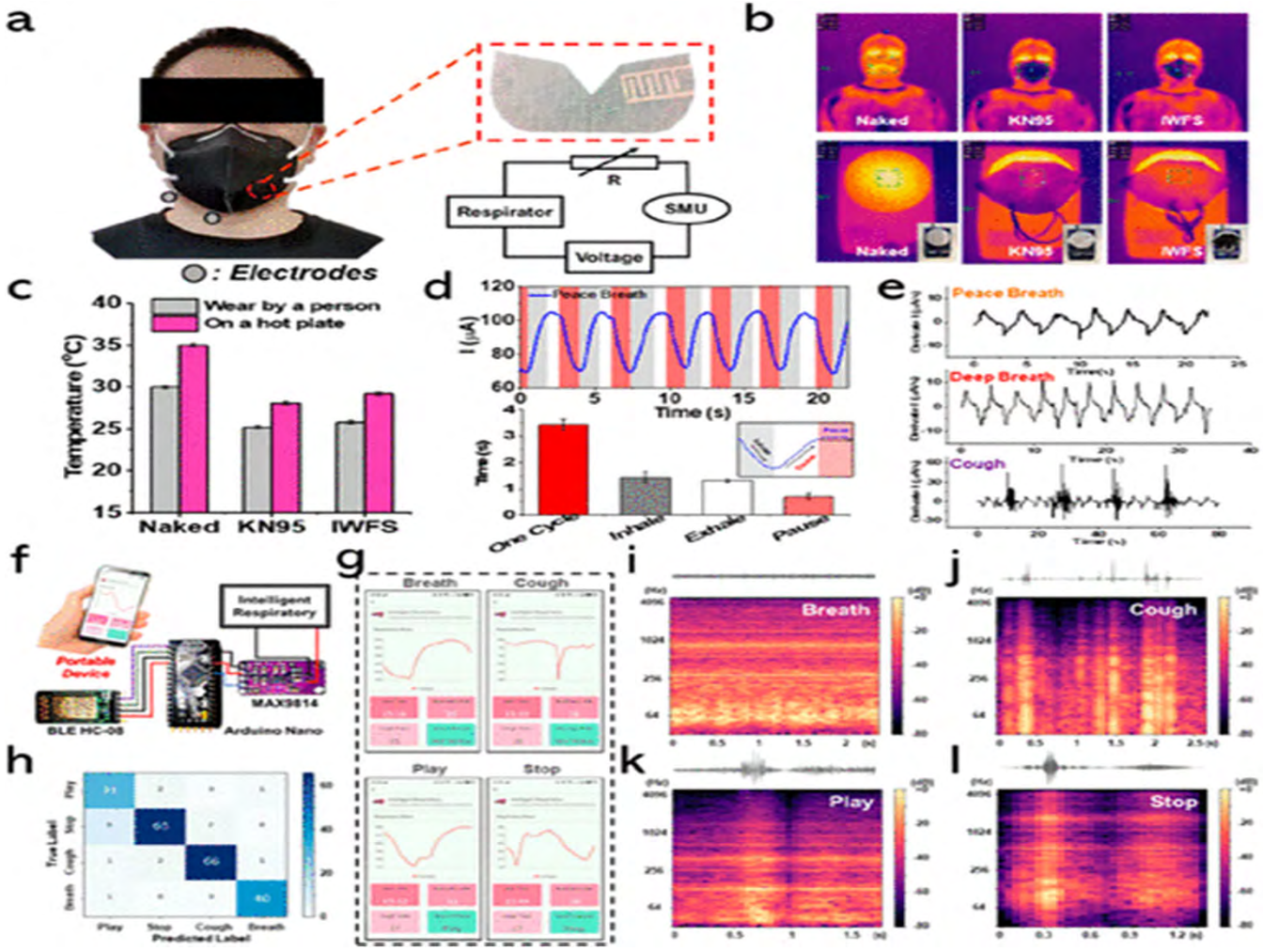
An Intelligent Wearable Filtration System for Health Management



Multifunctional face mask with high filtration efficiency and signal-sensing ability.

https://doi.org/10.1021/acsnano.3c02099

An Intelligent Wearable Filtration System for Health Management



Multifunctional face mask with high filtration efficiency and signal-sensing ability.

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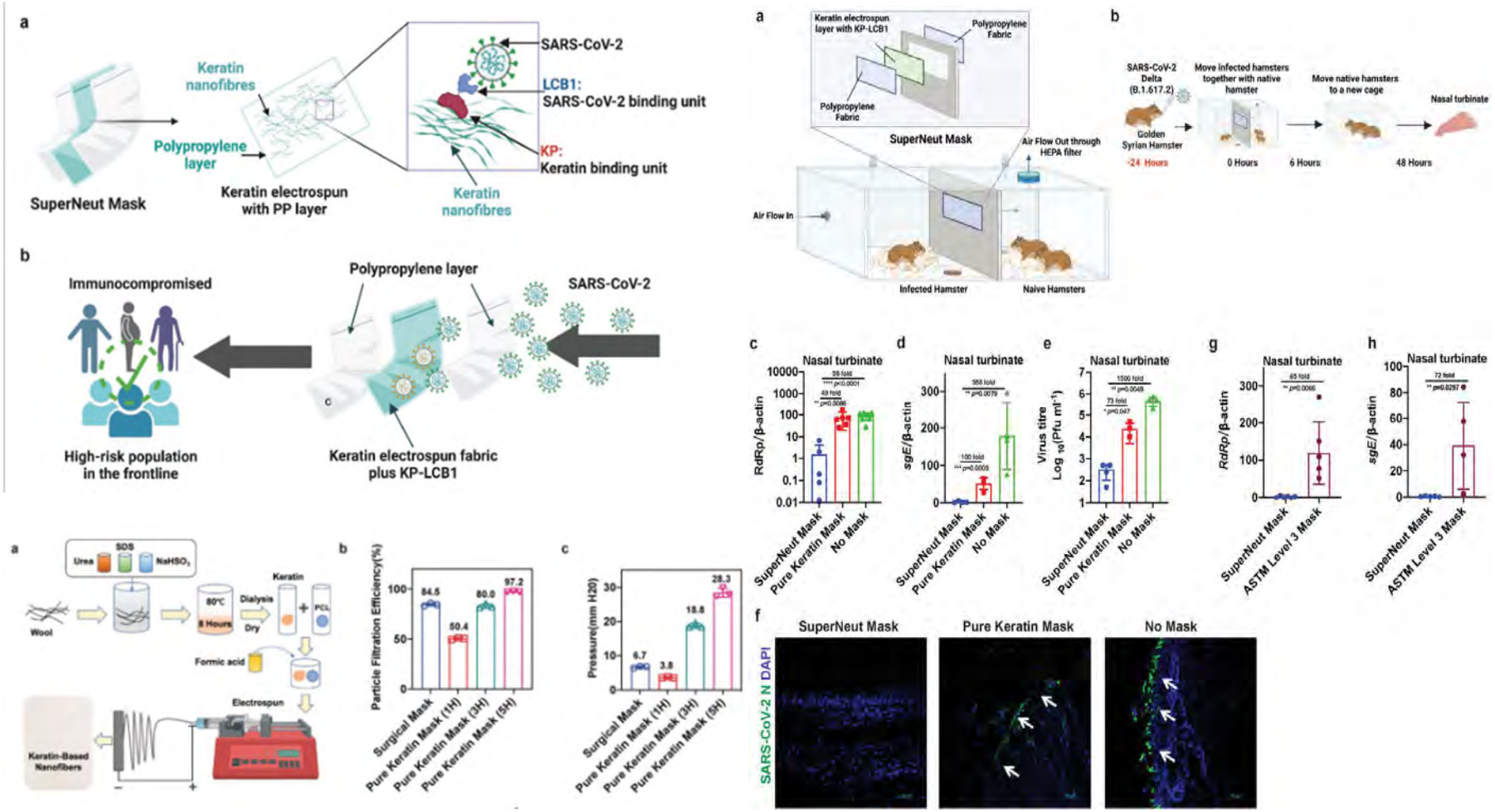
Protein-Based Face Mask with High SARS-CoV-2 Neutralization Ability and Breathability

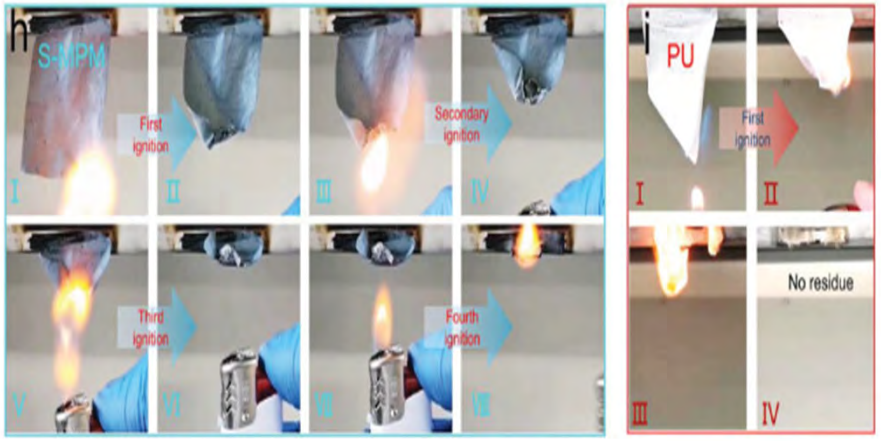


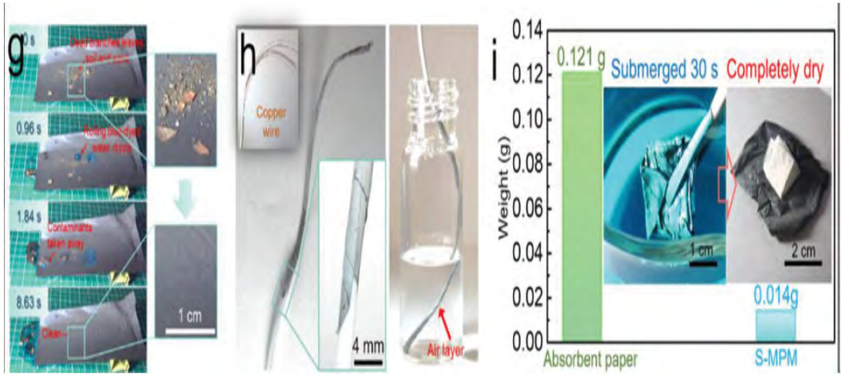
Electrospun protein-based masks for anti-COVID-19 virus.

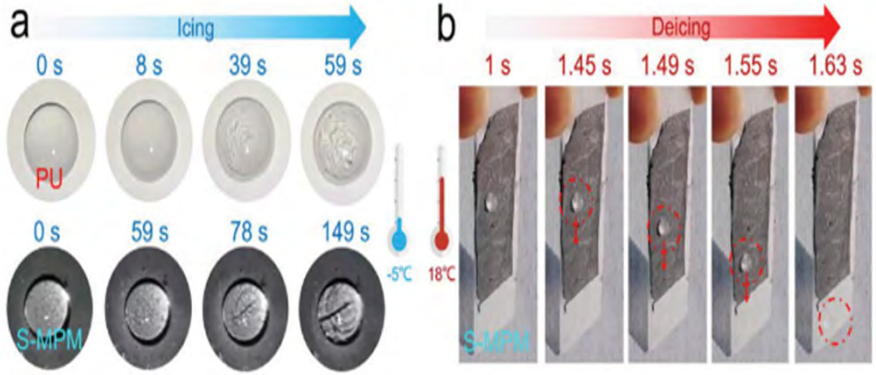
https://doi.org/10.1002/admt.202300590

Protective Clothing

Bioinspired Hierarchical Multi-Protective Membrane for Extreme Environments via Co-Electrospinning-Electrospray Strategy



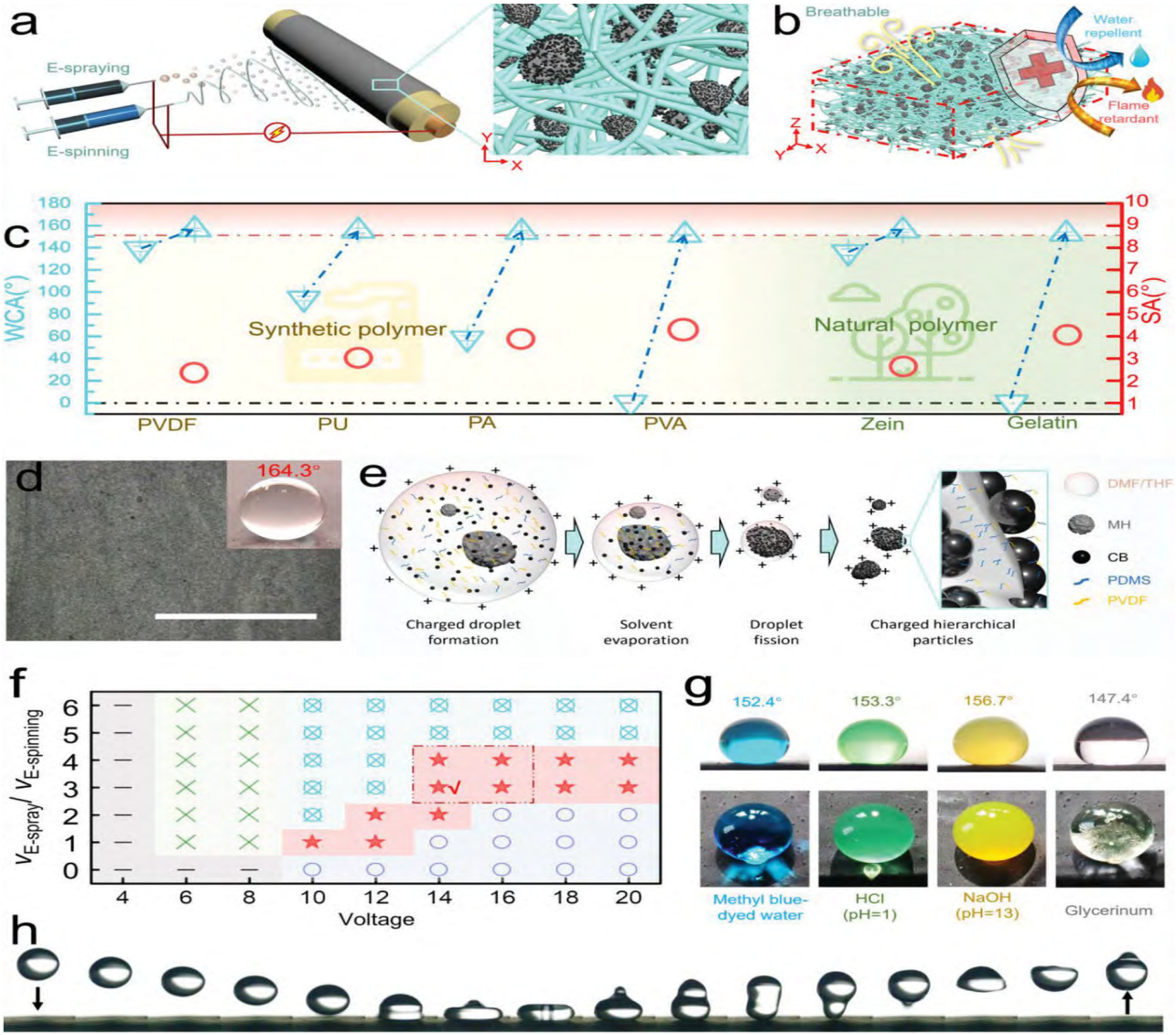


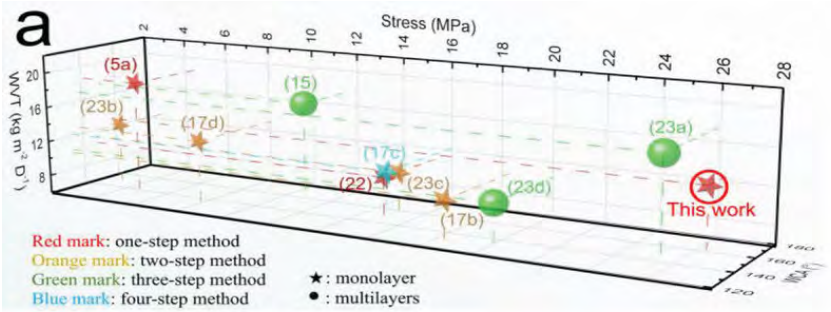


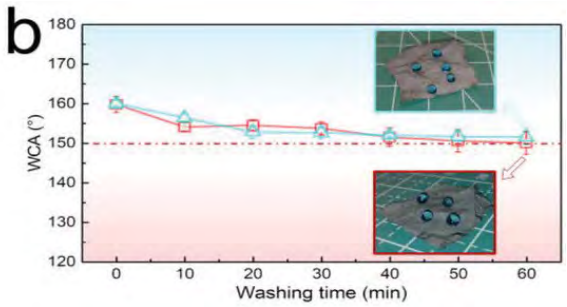
Nonwovens from electrospun and electrospray technologies for protective clothing. It is breathable and fire-retardant.

https://doi.org/10.1002/smll.202304705

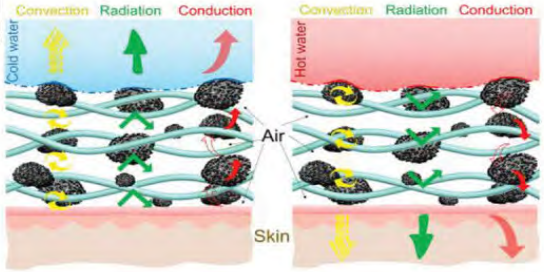
Bioinspired Hierarchical Multi-Protective Membrane for Extreme Environments via Co-Electrospinning-Electrospray Strategy

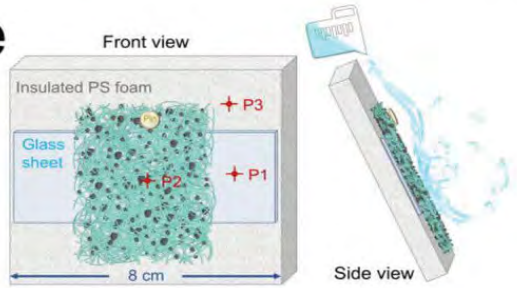


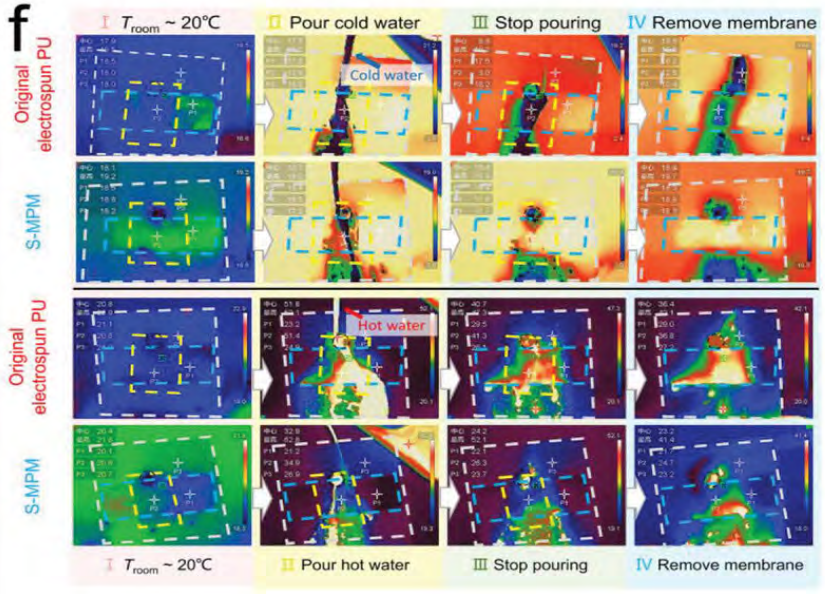

a
Stress (MPa)
WVT (kg m⁻² D⁻¹)
(5a)
(23b)
(17d)
(15)
(17c)
(22)
(23c)
(17b)
(23d)
(23a)
This work
Red mark: one-step method
Orange mark: two-step method
Green mark: three-step method
Blue mark: four-step method
★: monolayer
●: multilayers

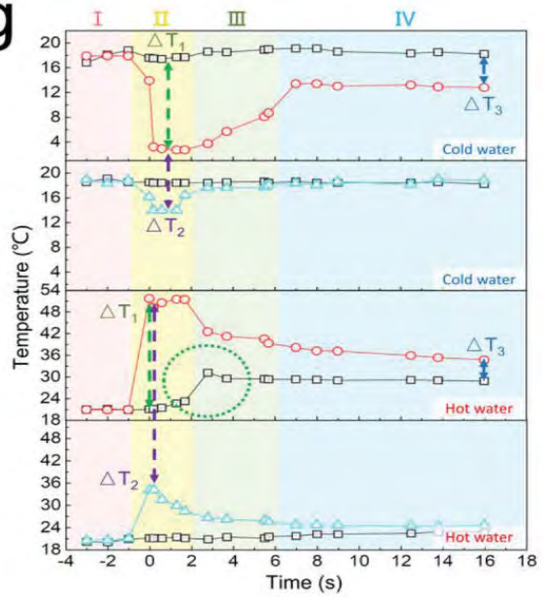

b
WCA (°)
Washing time (min)

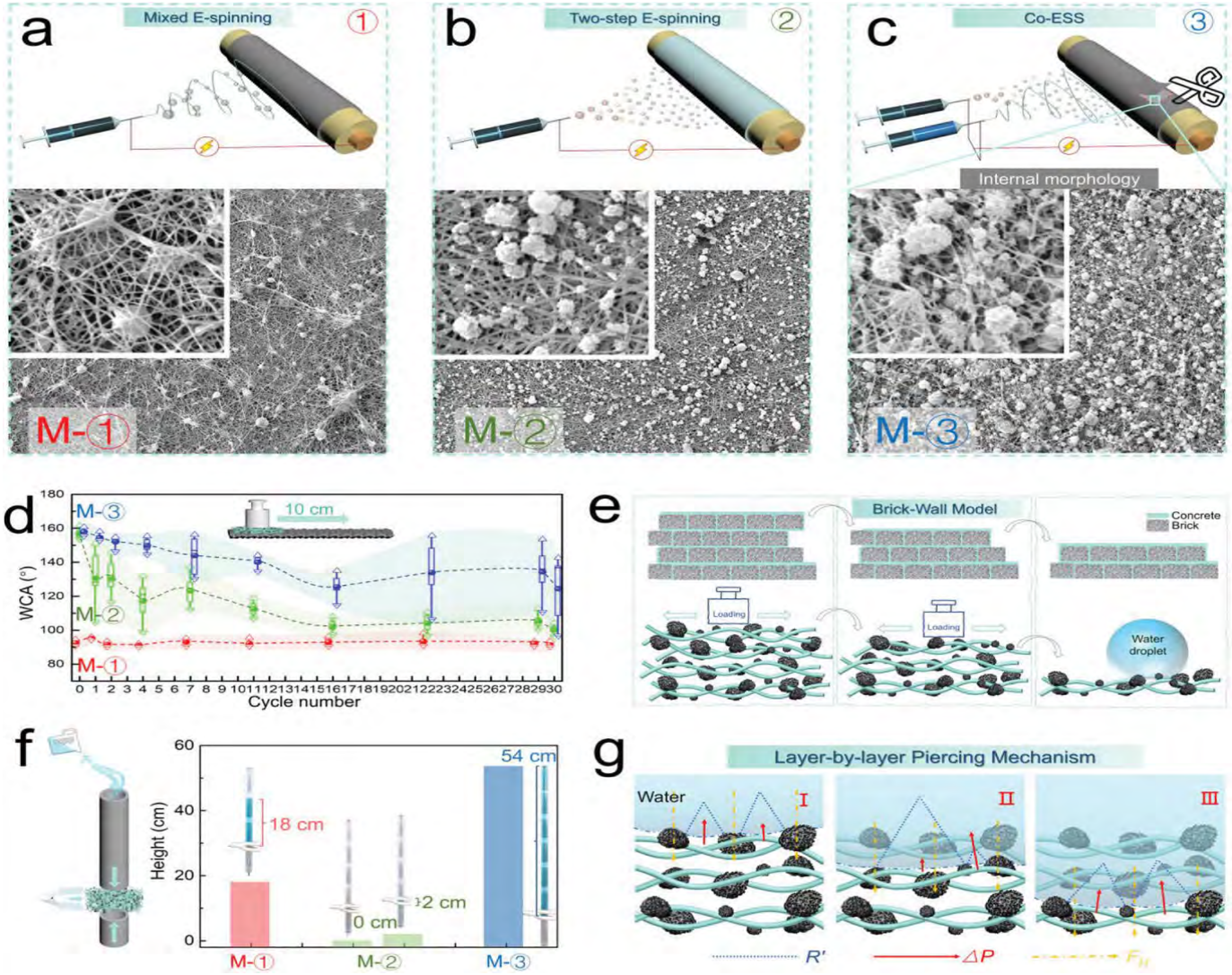

c
Hot water
(60 °C)


d
Convection
Radiation
Conduction
Cold water
Air
Skin
Hot water


e
Front view
Insulated PS foam
Glass sheet
P1
P2
P3
8 cm
Side view

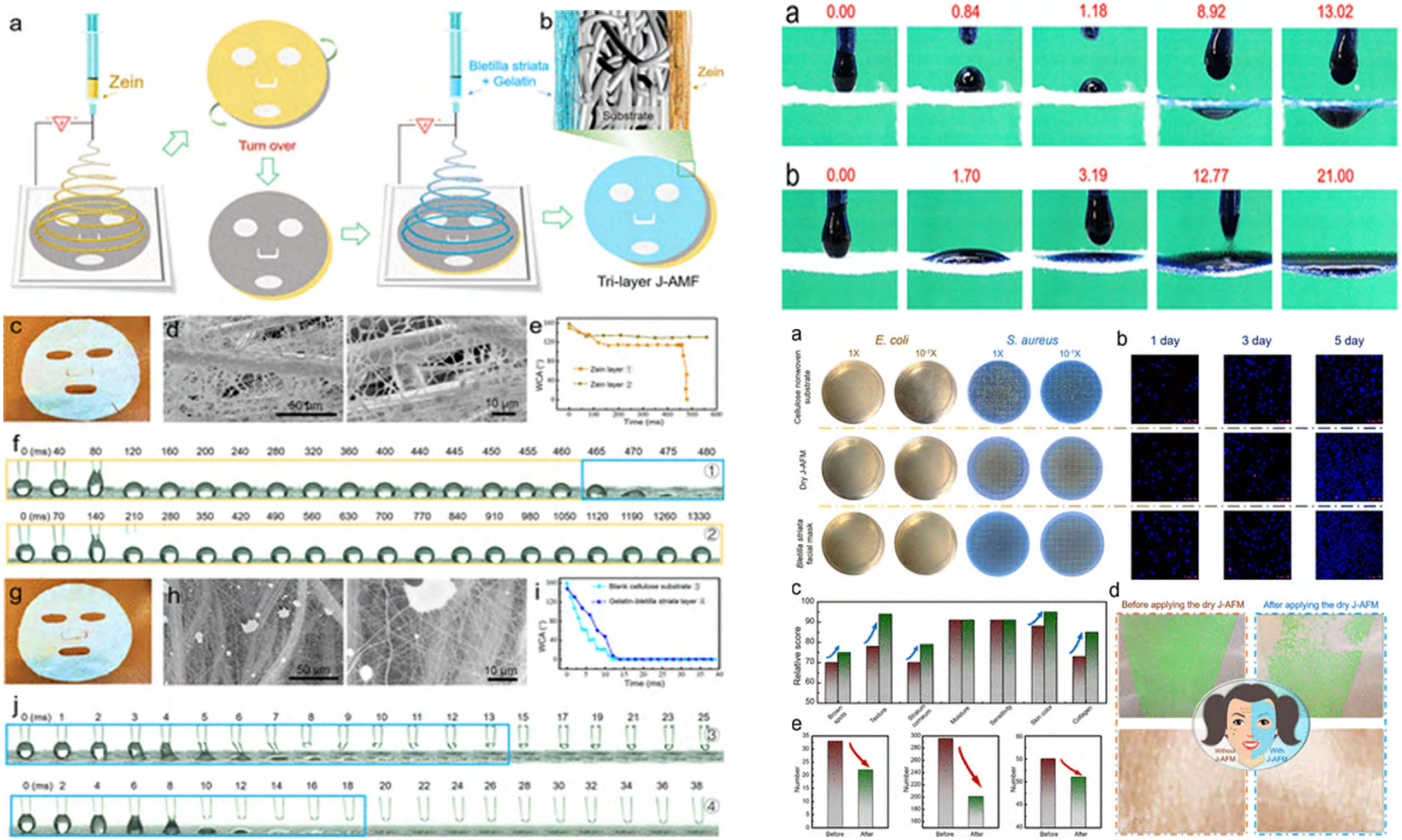

f
I T_room ~ 20°C
II Pour cold water
III Stop pouring
IV Remove membrane
Original electrospun PU
S-MPM
Cold water
Hot water
I T_room ~ 20°C
II Pour hot water
III Stop pouring
IV Remove membrane


g
I
II
III
IV
ΔT1
ΔT2
ΔT3
Cold water
Hot water
Temperature (°C)
Time (s)


a
Mixed E-spinning
①
M-①
b
Two-step E-spinning
②
M-②
c
Co-ESS
③
Internal morphology
M-③
d
M-③
M-②
M-①
10 cm
WCA (°)
Cycle number
e
Brick-Wall Model
Concrete
Brick
Loading
Loading
Water droplet
f
Height (cm)
18 cm
0 cm
54 cm
M-①
M-②
M-③
g
Layer-by-layer Piercing Mechanism
Water
I
II
III
R'
ΔP

Others

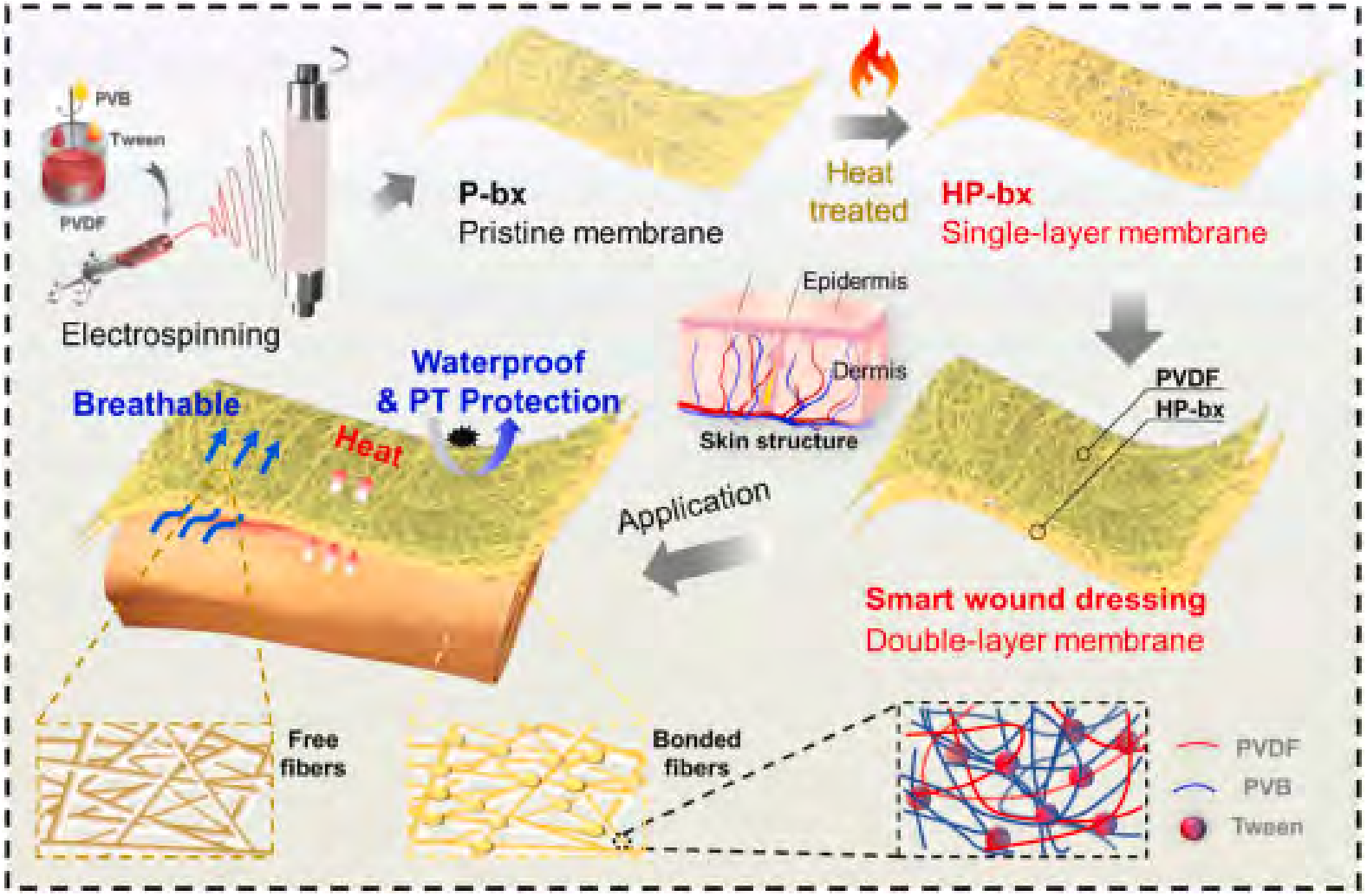
Electrospinning Membranes with Directional Water Transport as Ecofriendly Dry Facial Masks



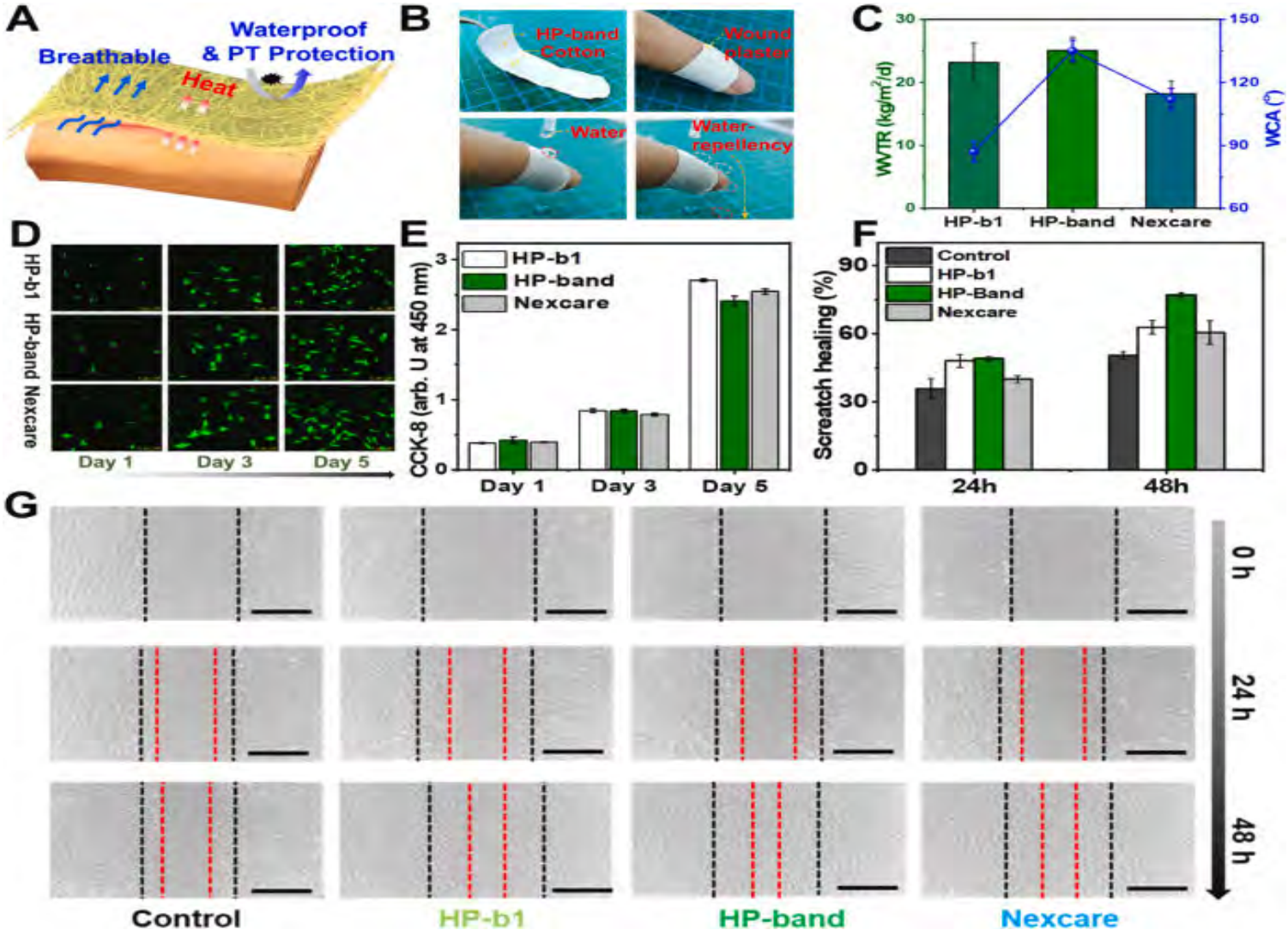
Janus facial mask with directional water transport properties.

Advanced Materials Technologies, DOI: (10.1002/admt.201600015)

A skin-like nanostructured membrane for advanced wound dressing



A skin-like nanostructured membrane for advanced wound dressing



Conclusions

1. Nonwovens are versatile and cost-effective technologies compared with traditional woven and knitted fabrics.
2. Nonwovens have huge applications in Apparel and textiles
3. Electrospun nonwovens are becoming feasible and provide huge opportunities
4. Nonwovens now can be modified with advanced and multiple functions to meet new and challenging textiles and apparel requirements by electrospinning


Thank you