

# 中国人造草坪行业 的发展现状

## The Development Status of Artificial Grass Industry in China

泰山集团

乐陵泰山人造草坪产业有限公司

Taishan Sports Group

Leling Taishan Artificial Turf Industry Co.,Ltd

# 报告提纲

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The vision of artificial grass industry

# 人造草坪在中国的发展历程

## The development history of artificial grass in China

- 20世纪90年代末，人造草坪产品进入中国市场。

- 进口草坪

By the end of 1990s, artificial grass enters into Chinese market.

- imported grass

- 21世纪初，泰山集团、江苏众联等企业开始了人造草坪的生产。

- 以进口草丝为原料，进行草坪的编织生产

In the beginning of 21st century, Taishan Group and Jiangsu Zhonglian begin to produce artificial grass.

- Use material of imported fiber and tuft by themselves

- 草坪产业集群的形成。

- 形成了以泰山、众联、共创、熊猫、MIE、火炬等企业为领导的产业集群。

The formation of artificial grass industry cluster.

- The industry base leaded by Taishan, CoCreation, Panda, MIE, Torch is founded.

- 国内企业开始人造草丝的生产

- 泰山集团与华东理工大学合作，06年引进了世界上最先进的拉丝机，草坪编织机等生产设备。开始自产草丝，编织草坪。

Domestic companies start the production of artificial yarn.

- Taishan, cooperated with ECUST, brings in the most advanced Extrusion machines and Tufing machines in 2006. She begins to manufacture her own yarn.

# 人造草坪产品的应用

## --应用面积

### The application of artificial grass

#### --Application area

- 1990 年，我国近 1 万平方米的人造草坪运动场
- In 1990, around 10,000 square meters artificial grass was installed in China.
- 1997 年- 1999 年，应用面积增长到 50 万平方米
- 1997-1999, the applying area increased to 500,000 square meters.
- 2000-2001 年应用面积达到 150 万平方米。
  - 2000-2001, it reached 1.5 million square meters
- 应用最广的就是运动场。
- The most widely used application is sports ground



# 人造草坪产品的应用

## --应用范围

### The application of artificial grass

#### --Application scope

- 开始仅大中专院校综合运动场应用
- At first, only used in the sports fields of universities and colleges
- 随后中小学运动场大面积应用。
- Then, widely used in the playgrounds of primary and middle schools
- 应用范围：
  - 由足球场地转向曲棍球、高尔夫球、篮球、门球、跑道、网球、棒球等运动场地。
  - 休闲及功能用：庭院的绿化、幼儿园的安全地面等

#### Application scope:

-From soccer to hockey, golf, basketball, paddle, tennis, baseball fields and so on.

-Leisure application: Courtyard landscaping, safety surface of kindergarten and so on.



机场Airport



庭院Courtyard



幼儿园Kindergarden

# 产品质量分析-----草坪标准

## The Analysis of Product Quality

### ---The standard of artificial grass

- 进口草坪，质量优良
- Imported grass, with high quality.
  - 本世纪初，人造草坪是进口草丝加工而成,质量优良。
  - At the begining of 21st century, artificial grass is made from imported yarn, so it is of high quality.
- 以次充好，质量低劣
- Fake grass appears, with low quality.
  - 随生产厂家增多，一些不负责任的厂家，以次充好，生产质量低劣的人造草坪，使得国内人造草坪市场混乱，形成了恶性竞争的态势。
  - As more factories enter into this area, some companies who are irresponsible produced a lot poor quality products,which result in market mass and cutthroat competition.
- 草坪标准出台
- The introduction of artificial grass standards
  - 为了控制草坪质量, 2006年发布了人造草坪的国家标准 (GB/T 20394-2006)
  - In order to control the qualityt, the relavent authority issues the National Standard of Artificial Grass in 2006.

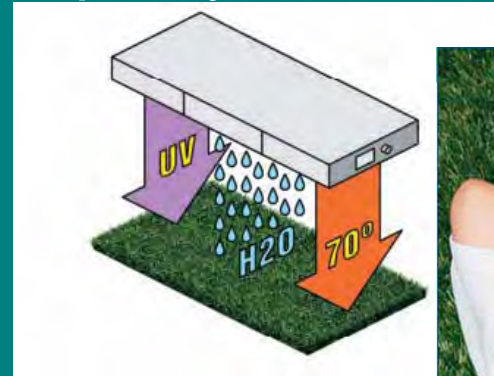


# 产品质量分析

## The analysis of product quality

- 影响草坪质量的指标
- The factors that affect grass quality:

- 抗老化性
- Anti-aging ability



- 环保性能
- Environment -friendly character

- 综合性能
- comprehensive characteristics



# 产品质量分析

## The analysis of product quality

- 影响抗老化性能的因素
- The factors that affect Anti-aging ability
  - 抗老化剂的品质
  - The quality of Anti-aging inhibitor
  - 抗老化剂的用量
  - The quantity of Anti-aging inhibitor
  - 抗老化性能的评价
  - The evaluation of Anti-aging ability
    - 抗老化指标的检测，费用高、周期长
    - The test of Anti-aging ability is expensive and needs a long time cycle

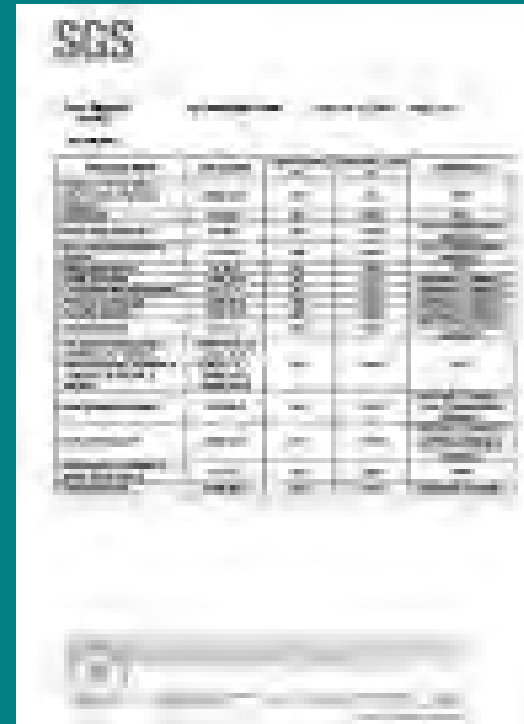




# 产品质量分析

## The analysis of product quality

- 影响环保的因素
- The factors that affect environment
  - 劣质化学添加剂
  - Poor-quality chemical additive
  - 重金属
  - Heavy metal
  - 环保的评价
  - Environmental evaluation
- 专业的检测设备，检测机构
- Professional testing machines and testing institutions



# 产品质量分析

## The analysis of product quality

- 草坪的综合性能
- The comprehensive performance of artificial grass
  - 物理机械性能与进口草坪处于同水平
  - Physical mechanical properties are similar with imported grass
- 耐磨性、柔软性等运动性能相关的指标与进口产品还有一定差距。
- On sports performance such as abrasion resistance, softness, the products still need to be improved compared with imported products.
- 但规模较大，综合实力较强的企业始终在致力于高端人造草坪的生产和研发。其中以泰山集团下属的子公司——乐陵泰山人造草坪产业有限公司最为突出。
- However, some large-scale companies have been devoted to the R&D of high-quality products. And Leling Taishan Artificial Turf Industry Co.,Ltd which is the subsidiary of Taishan Group is one of the most prominent in China.

# 产品的研发进展-行业现状

## The R&D of Product

### Current status of artificial grass industry

- 国内相当多草坪生产企业，经济实力不足，研发能力弱。
- **There are many turf companies in China, lack of finance and weak in R&D ability.**
  - 处于质量低劣、价格低廉的草坪生产阶段；
  - 使用的设备：改造的旧的地毯机械，幅宽只有80厘米，反复加工几次才形成4米以上幅宽；
  - 使用的原料：进口草丝掺杂一些低劣的草丝生产草坪。
  - They are in the period of poor-quality and cheap turf producing.
  - The machines they use: most are refitted from old carpet machines, the width can only reach 80cm, 4m width will need a lot of additional work.
  - The materials they use: imported yarn ,together with poor-quality yarn
- 行业引领企业泰山集团，江苏共创等致力于草坪的研究开发工作
- **The industry leaders such as Taishan Group and CoCreation etc. are devoting to artificial turf R&D area.**
  - 针对抗老化性能、耐磨性能、柔软性能，投入较大资金（仪器、设备）、人力（聘请专业人才）、物力（机械设备、附属设备）进行研究
  - Aiming at improving anti-aging character, abrasion resistance and softness, we give a large amount of investment on the machines, human resources, and other facilities.

# 产品的研发进展 --泰山集团研发

## The R&D of Product--Taishan Group

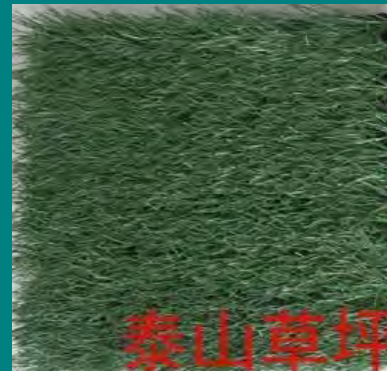
- **产研合作机构:** 泰山集团先后与山东大学、华东理工大学、北京化工大学、山东省科学院等科研院所建立了长期合作关系，及时转化科研成果，使得泰山集团成为体育行业屈指可数的高新技术企业。
- **The production and research cooperated institutions:** Taishan group has built long term cooperating relationship with Shandong University, ECUST, Beijing University of Chemical Technology, Shandong academy of sciences sucessfully. It is helpful to the application of science achievements in time, which makes Taishan Group become one of the top and outstanding high-tech enterprises in China.



# 产品的研发进展--泰山集团研发

## The R&D Development of Product--R&D of Taishan Group

- 泰山集团始创于1978年，在卞志良先生的带领下，经过30多年的艰苦卓越的奋斗，一举而成为在业内颇具影响力的集团公司。
- Established in 1978, under the leadership of Mr Bian Zhiliang, Taishan Group has become one of the influential Group company in this industry after 30 years of hard work.
- 产品涉及XPE、碳纤维、竞技器材、健身器材、人造草坪、网络健身运动项目等等。
- Products scope: XPE, carbon fiber, athletic sports equipments, fitting sports equipments. artificial turf, online fitness sports, and so on.
- 现在已经成立国家级技术中心、国家级工程技术中心、博士后流动工作站，并成功为多个综合性运动会（包括2008年北京奥运会）提供器材等配套设施。品牌价值118亿。
- Now we have established National technology center, National engineering technology center, and have become the sports equipments supplier of many sports meetings(including 2008 Olympic Games). The value of Taishan brand has reached 11.8 billion.



# 产品的研发进展——树脂改性研究

## R&D Progress--Research of Resin Modification

- 目的：运动类人造草坪对草坪的综合性能指标要求越来越严格。
- **Purpose:** The requirements for overall performance index of sports artificial turf become more and more strict.
  - 环保要求——不得含有任何危害人类健康的重金属以及污染类物质。
  - **Environmental requirement--Any heavy metal and pollutant that harm human health cannot be contained.**
  - 性能要求——和天然草一样对人体没有摩擦损害，具有更柔软舒适的感觉，优于天然草坪的弹性和适宜的摩擦性能。
  - **Performance requirement--Artificial turf shall be without friction damage to human body like natural grass, feel softer and more comfortable, and have better elasticity and proper friction performance.**
  - 国内常规树脂达不到要求
  - **Conventional domestic resin cannot meet the above requirements.**



# 产品的研发进展——树脂改性研究

## R&D Progress--Research of Resin Modification

- 选定主体树脂（树脂1）后，再通过添加适宜的树脂（树脂2）（提供草坪所需的性能的）成分进行改性。通过反复实验、测试、筛选，最终确定了以国产树脂为主体，以改性树脂为辅的配方体系，不但保证了成品草坪的综合性能，还较大幅度的降低了成本。为人造草坪的普及推广奠定了基础。
- The modification is performed through adding appropriate resin(resin 2, to offer certain required performance) in the selected resin (resin 1). After repeated experiment, test and screening, the formula system with domestic resin as main part and modified resin as supplement is finally selected, which not only ensures the overall performance of turf, but also substantially reduces the cost, laying the foundation of spread and promotion of artificial turf.



# 产品的研发进展——抗氧化剂的应用研究

## R&D Progress--Application Research for Anti-aging Agents

- 目前常规的抗氧化添加剂以紫外线吸收剂、屏蔽剂等合成化学药品为主。这些合成化学助剂，无论是在合成过程中，还是在使用过程中，都会形成一定的环境污染。
- **At present, the conventional anti-aging additives mainly consist of synthetic chemicals, such as UV absorber, screening agents and others, which always bring environmental pollutions to some degree, no matter in the process of combination or application.**
- 利用**无机纳米材料**的尺寸效应——对紫外线反射作用，作为主要的抗氧化药品其抗紫外线效果，和现在流行的合成受阻胺类相比，效果并不逊色，而且具有增强的作用。该类物品的应用，减少了有机合成化学物质的毒性污染，减少使用过程中对人体的危害，保护了环境。
- **Taking advantage of its size effect -the reflex action towards ultraviolet, **inorganic nano materials** is used as the main anti-aging material. Comparing with the current popular synthetic HAKS, it effects not inferiorly but better in UV resisting. This application not only reduces the toxic pollution of organic synthetic chemicals but lessens the harm to human body during application. Thus, it achieves protection of environment.**



天然納米礦物抗紫外線

纳米矿物材料抗紫外线  
Nano Anti-UV Mineral Materials



# 产品的研发进展——加工助剂应用研究

## R&D Progress--Application Research for Processing Agents

- 研究了各种添加剂对人造草丝性能的影响。
- **Study the effects of various additives on artificial yarn performance**
  - 通过添加不同的**成核剂**，使树脂的结晶程度和结晶形状改变，然后进行物性分析和实物测试。最终选定有效的添加剂，使草丝、草坪，达到最佳性能。
  - **Change the crystallization level and shape of resin by adding different **nucleating agents**, then make physical property analysis and test, finally select the effective additive to achieve the best performance of yarns and turf.**



成核剂  
**nucleating agents**

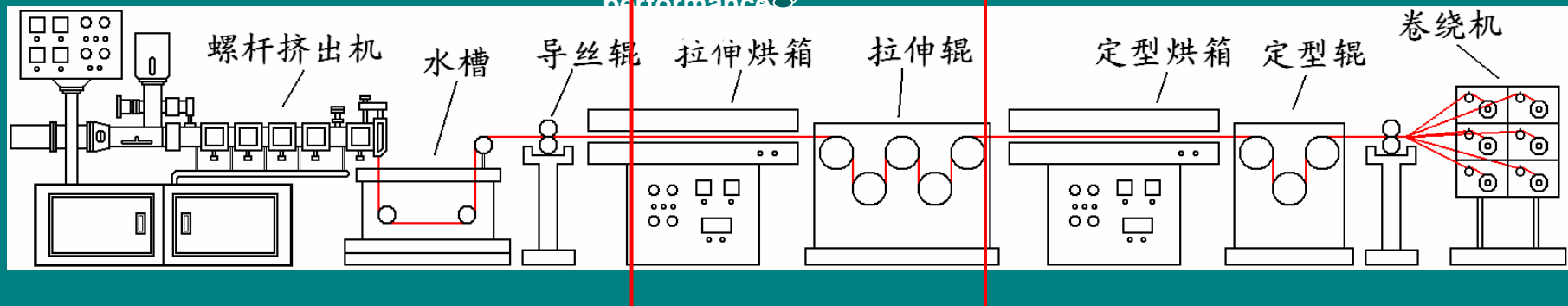
# 产品的研发进展——拉丝工艺的研究

## R&D Progress--Research for Stretching Process

- 着重研究了人造草坪的性能与工艺之间的关系。
- **Mainly study the relationship between artificial turf performance and the process.**
- 从调整拉丝工艺，改变树脂的不同结晶形态，使之表现出不同的性能，然后再对不同性能的草坪做物性分析，并进行综合的性能测试，然后筛选出最佳的工艺，使之符合人造草坪用途的要求。
- **Adjust stretching process to change the different crystallization forms of resin and give them different properties, then make physical property analysis for turfs with different performance, carry out comprehensive performance test, finally choose the best process to meet the requirements of artificial turf.**

改善草丝  
力学性能

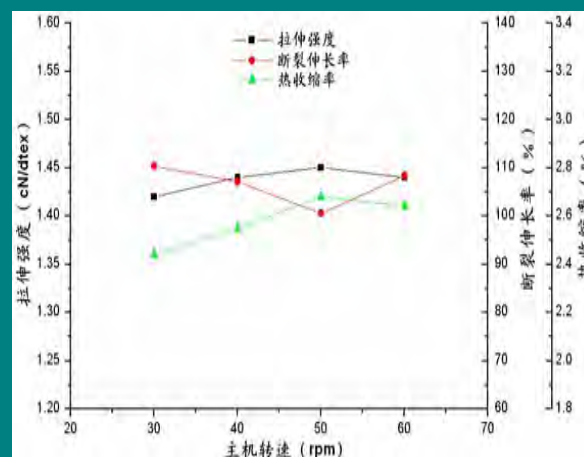
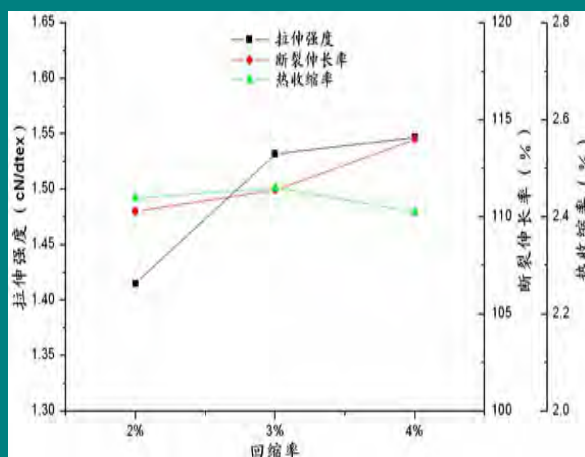
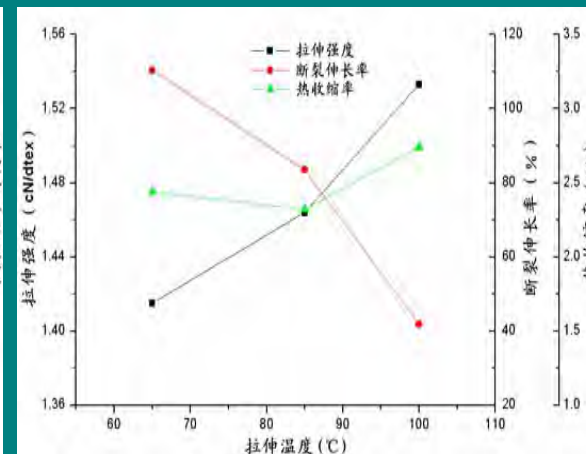
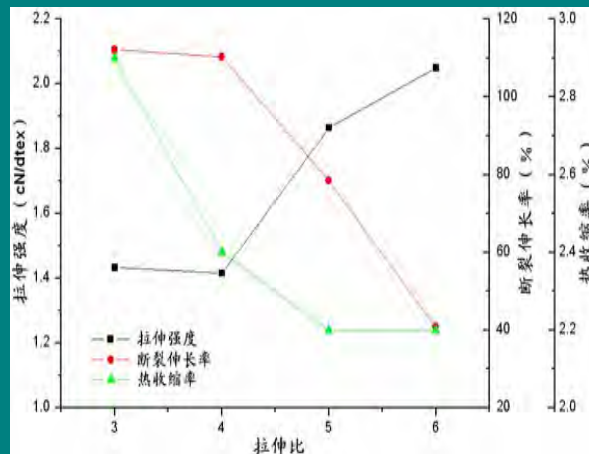
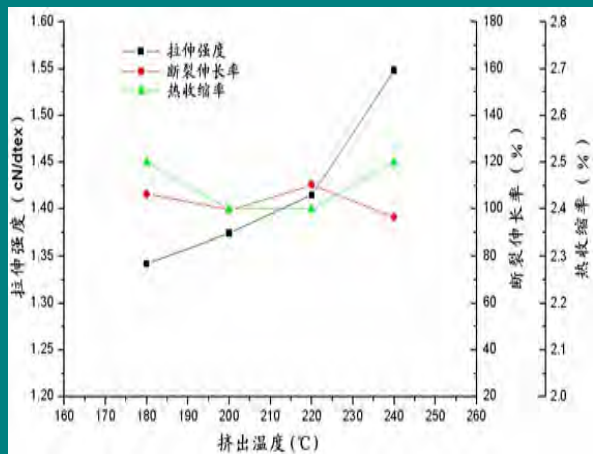
Improve  
mechanical  
performance



# 产品的研发进展

## ——拉丝工艺Vs性能

### R&D Progress--Stretching Process VS Performance



# 产品的研发——柔软草丝的研究

## R&D of Products--Research of Soft Yarn

- 研究了柔软草丝的**配方及合成工艺**。通过在常规树脂中添加一定分子量的柔性树脂，使成品人造草丝的柔软性能达到较好的效果，用手摸起来柔顺、舒适。
- **Study the formula and synthesis process** of soft yarn. By adding certain molecular weight of soft resin in conventional resin, softness of artificial yarns achieve better effect and feels soft and comfortable by hand.



柔软草丝人造草坪Soft  
yarn of artificial turf

# 产品的研发——耐久性的研究

## R&D of Product--Research of Durability

- 为提高人造草坪的使用耐久性，国内企业就人造草丝的**耐磨性能**进行了多方面的研究。从树脂的选型到树脂的改性，通过大量实验，目前我们的人造草丝纤维，依据**FIFA**新概念的检测方法，耐磨次数已达**40000**多次，而人造草纤维几乎没有开叉现象。
- In order to improve durability of artificial turf, many domestic enterprises involves in various researches of **wear-resisting property** of yarn. We carry out large quantities of experiments from resin selection to resin modefication. At present, under the test method of FIFA new concept, our artificial yarn can bear up to 40,000 times wear almost without any jags.

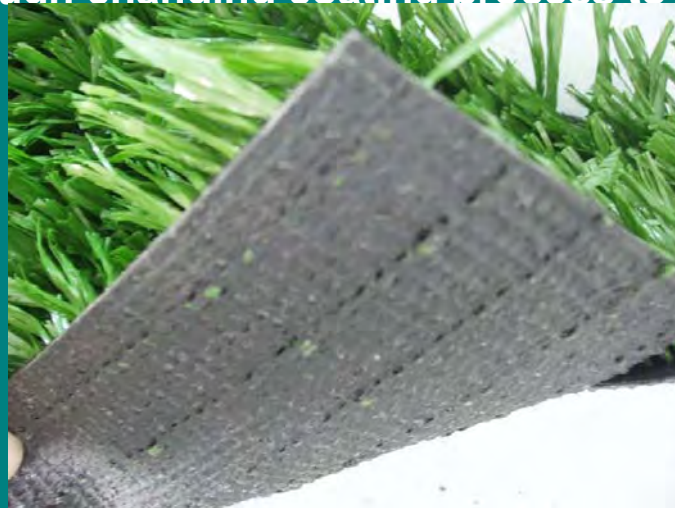


Lisport耐磨损机 Lisport Wear-resistance Machine

# 产品的研发——人造草坪循环利用

## R&D of Product--Recycling of Artificial Turf

- 回收循环利用是人造草坪提高利用价值，节省能源，从而促进环保的最好途径。
- **Recycling is the best way to improve the value of turf, achieve energy-saving and then promote environmental protection.**
  - **涂覆(背胶)材料**，选择和草丝成分同属一类的物质作为背胶主体成分，通过材料改性使草丝和涂覆物两者具有更好的粘结性。这样的人造草坪达到使用年限以后，人造草坪清理后整体回收再次进行加工利用。
  - **Coating materials:** To use materials that belong to same variety with yarn ingredients as main ingredient, after modification, both yarns and coating materials have better cohesiveness. When service life ends, these artificial turf can be entirely recycled and reused after clearance.
  - **背胶工艺:**通过改变背胶工艺，改进回收再利用的方式。
  - **Coating process:** Through changing a coating process to improve recycling method.



# 产品的检测

## Product Testing

- 人造草坪检测项目中:产品的抗紫外线能力, 国际上通用的检测方法是使用UV-A进行人工老化, 耗时四个多月, 这对产品的及时检验带来了不便, 而且费用很高。
- Test item of artificial turf: **anti-UV property**. The common testing method used internationally is achieving artificial aging with UV-A, taking more than 4 months, which is inconvenient for timely testing and also cost a lot.



QUV加速老化仪 QUV Accelerated Aging Instrument

# 产品的检测

## Product Testing

- 通过测试**草丝中抗老化剂的成分及其含量**这一手段进行检测。虽然费用仍然较高，但周期却可以大大缩短，由原来的4个多月减少为几个工作日。
- **Our testing is carried out by testing the ingredients and content of antiaging agents in the yarn.** Though it also costs a lot, the test period is greatly shortened, shortening from more than 4 months to a couple of work days.
- 这一手段的应用，必须对现有的抗老化药品在各种树脂中的抗紫外线数据进行摸索。而且对各种抗老化药品的组合进行研究。搜集数据成为该方法的难点。
- **By this testing method, it's necessary to explore the anti-UV data of existing anti-aging agents in various resins, and to study the combination of various anti-aging agents. So data collecting is the difficulty of this method.**





# 人造草坪行业展望

## Industry Outlook of Artificial Turf

- 人造草坪因其独特的耐候性、维护经济性、节省水资源、无需喷施农药、可全天候使用等特点而被广泛推广使用。自上世纪六十年代到目前为止近**50**年的时间每年都以两位数的速度递增。现在全球每年销售铺装各类草坪达到近**10000**万平米。
- **Artificial turf is widely used for its advantages, such as unique weather resistance, economical efficiency in maintenance, water saving, no pesticide and 24 hours using etc. From 1960s to now, during nearly 50 years, it increases with double-digits speed every year. Now all kinds of artificial turf are sold and installed upto nearly 100 million sqm globally every year.**
- 随着人类体育运动的普及，以及足球运动在人造草坪上的许可使用，同时因人造草坪用途的拓展，人造草坪仍将保持较快的速度递增。
- **With the popularity of human sports and the permission of playing soccer on artificial turf, as well as the extension of artificial turf application, artificial turf will maintain its rapid increase.**

# 人造草坪行业展望

## Industry Outlook of Artificial Turf

- 人造草坪未来趋势：
- Future trends of artificial turf:
  - 经久耐用：抗紫外线能力将大大增强，耐磨性能也将大大提高。
  - **Durable**: UV-resistance will be great enhanced and wear-resistance will be also greatly improved.
  - 柔软舒适：随着运动的普及，未来的草苗较高的草坪会更加柔软舒适，与人的接触性能更加完美。
  - **Soft and comfortable**: With the popularity of sports, the future turf with higher pile height will be softer and more comfortable, and its contact performance with human will be more perfect.
  - 可回收循环利用：随着地球资源的逐渐枯竭，可回收人造草坪将成为将来行业的趋势。
  - **Recycling**: As the earth's resources gradually exhaust, recycling artificial turf will become the trend in this industry in the future.
  - 不同用途的人造草坪将呈现出不同的特点，更加适合各自的应用。
  - **Artificial turf with different applications** will show different characteristics and suit their application better.

谢谢大家！  
Thank you!