功能型人造草丝的研究

Study on functional artificial turf fiber

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Outline

- 耐磨型人造草丝的研究
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- 释香型人造草丝的研究
  Fragrant releasing artificial turf fiber
- 阻燃人造草丝的研究
  Flame retardant artificial turf fiber

耐磨型人造草丝的研究

Wear resistant artificial turf fiber

- 新一代流行的运动草坪纤维虽然比前几代草坪运动性能大有改善，但是面对激烈的高强度运动对抗，草坪纤维还是呈现出一些不足，如强度较低、耐磨性差，开裂的草丝对运动员易造成扭伤等。

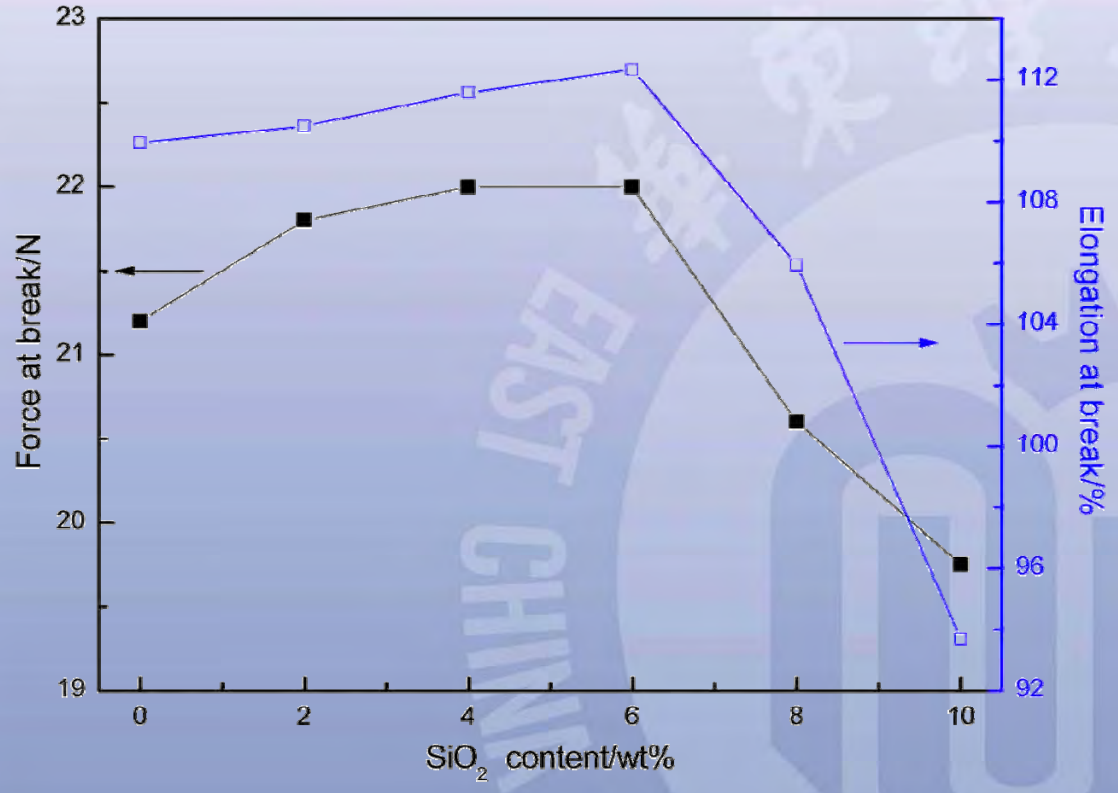
  There is a shortcoming of poor wear resistance for widely used artificial turf currently. With the time turf fibers have been worn and phenomena of fluff, branching and fracture occur on the surface of turf fibers, which will not only affect athletic performance, but also tends to cause injury to athletes.

- 采用纳米改性技术来提高运动草丝纤维(草坪)的耐磨性能

  Improve the wear resistance of turf/ yarn by surface modified nano-SiO_2

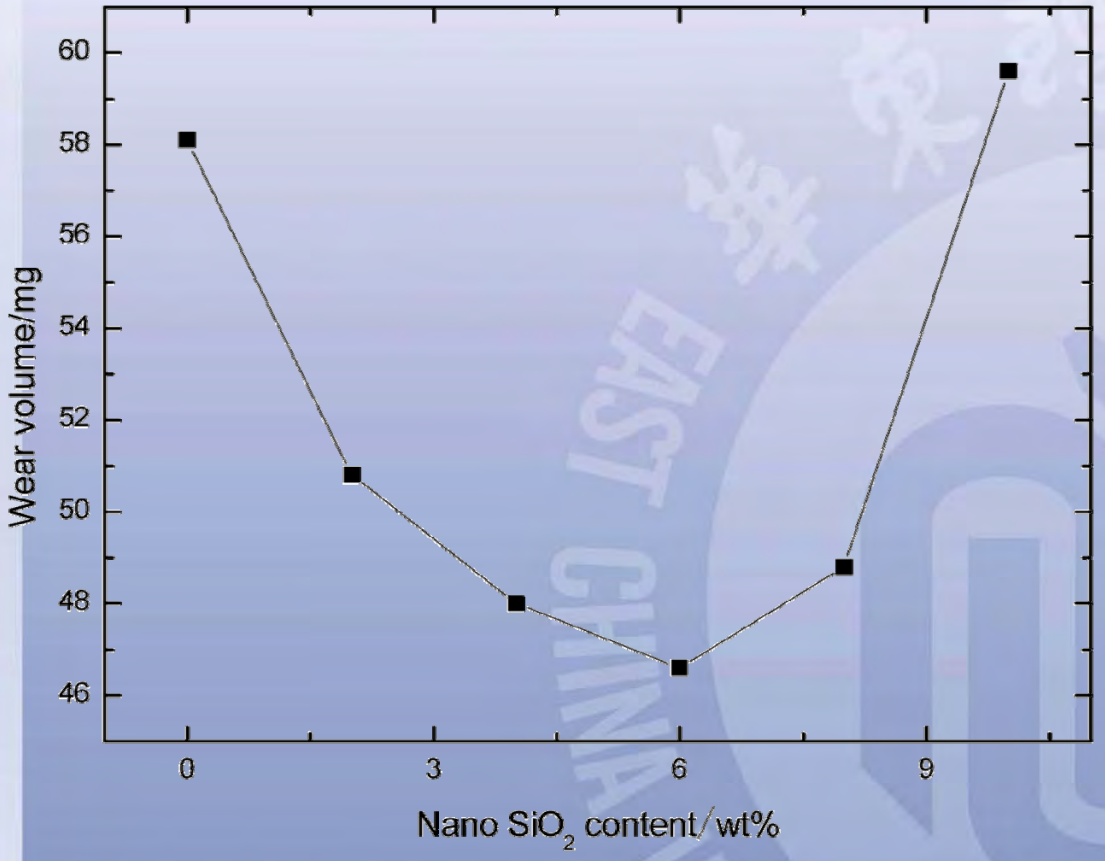
纳米SiO_2含量对草坪纤维力学性能的影响

Effect of nano-SiO_2 content on mechanical properties of monofilament fiber



纳米Si02含量对草坪纤维抗磨损性能的影响

Effect of nano -SiO_2 content on wear resistance of monofilament fiber



纳米SiO_2对人造草坪抗磨损性能的影响

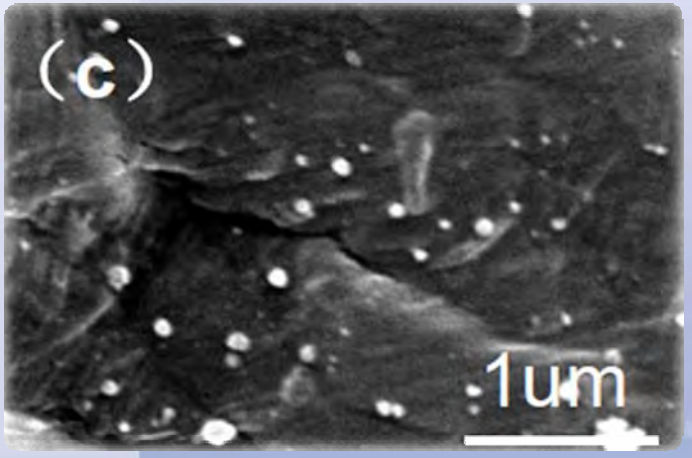
Effect of nano SiO_2 on wear resistance property of artificial turf

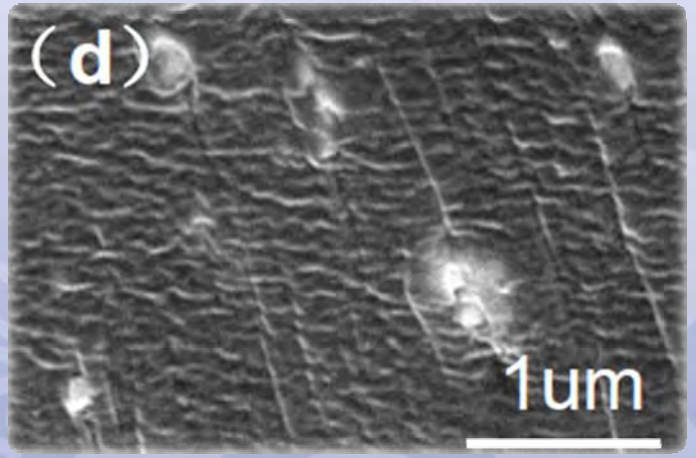
Unfilled

Filled with 6 %wt nano SiO2

人造草丝纤维SEM照片

SEM microscopes of cross sections of monofilament fiber





Filled with 6%wt nano-SiO_2

Filled with 10%wt nano-SiO2

小结
Conclusion

- 草丝纤维的断裂拉力和断裂伸长率在纳米SiO_2含量为6%时达到最大值，磨耗量比未添加纳米SiO_2时减少19.7%。

  Nano-SiO_2 can improve the mechanical properties of artificial turf fibers.

- 上述草丝编织的草坪，在人造草坪抗磨损测试仪上摩擦12000周期后，单丝纤维仅发生了轻微的磨损，几乎没有开叉现象，未添加纳米SiO_2的人造草坪单丝纤维磨损开叉现象严重，纳米SiO_2对人造草坪抗磨损性能具有显著的改善效果。

  Nano-SiO_2 has significant improvement effect on wear resistance of monofilament fibers and artificial turf. When the SiO_2 content is 6%, wear loss of monofilament fibers is 19.7% less than that unfilled sample. Only slight abrasion and branching phenomenon occurred after 12000 cycles' friction test.

释香型人造草丝

Fragrant releasing artificial turf fiber

- 为了制备似真草的芳香气味，利用吸附法制备芳香型香母粒，通过和树脂、色母粒等共混挤出的方法纺制芳香型人造草丝。

Preparation of grass-smell artificial turf fiber by adding fragrant masterbatch。 The master batch was made by adsorption method.

- 研究了香精与载体EVA的相互作用规律，草香型母粒对人造运动草丝的性能影响以及人造运动草坪纤维的留香时间等。

The interaction of essence with carrier EVA, the mechanical properties and fragrant releasing time of turf fiber were studied.

香母粒的制备[1.2.3]

Preparation of fragrant master batch

1. 温度对吸附量的影响

Effect of temperature on adsorption capacity

Temperature(℃)	Adsorption capacity(g/g)
0	5
10	0.08
20	0.18
30	0.56
40	1.15
>50	粘连

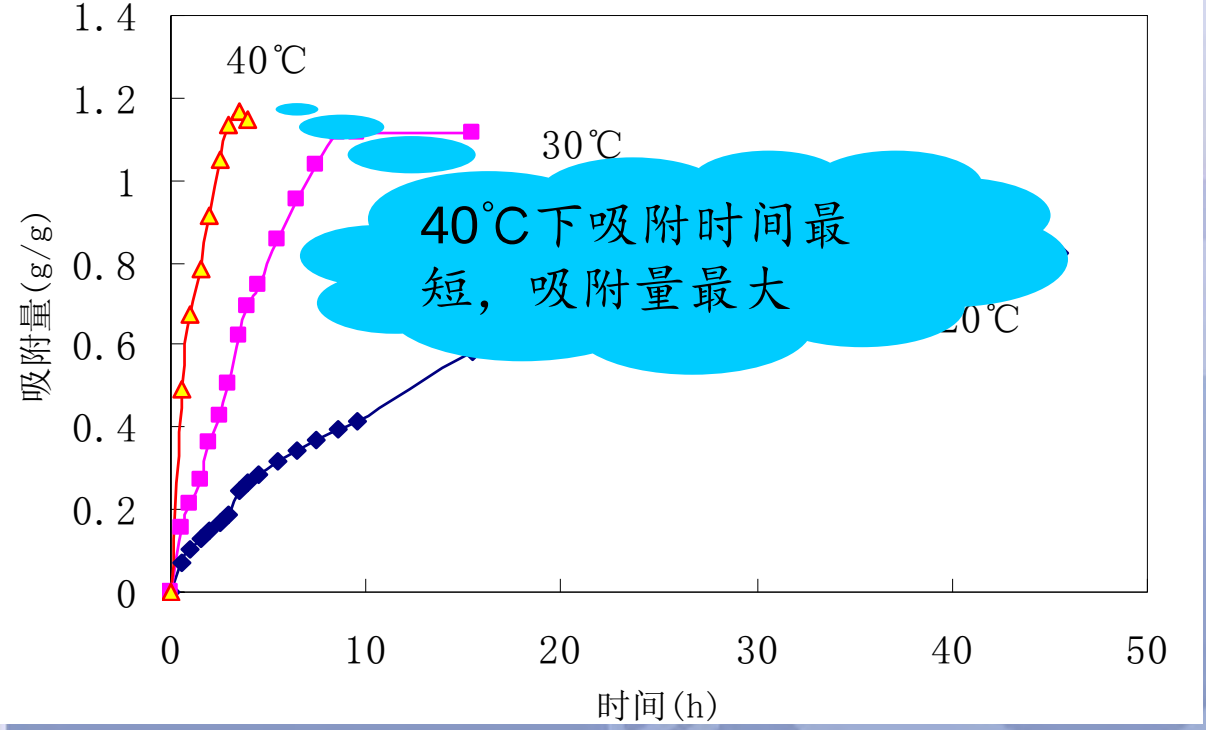
最佳温度范围

香母粒的制备[1.2.3]

Preparation of fragrant master batch

2. 时间对吸附量的影响

Effect of time on adsorption capacity

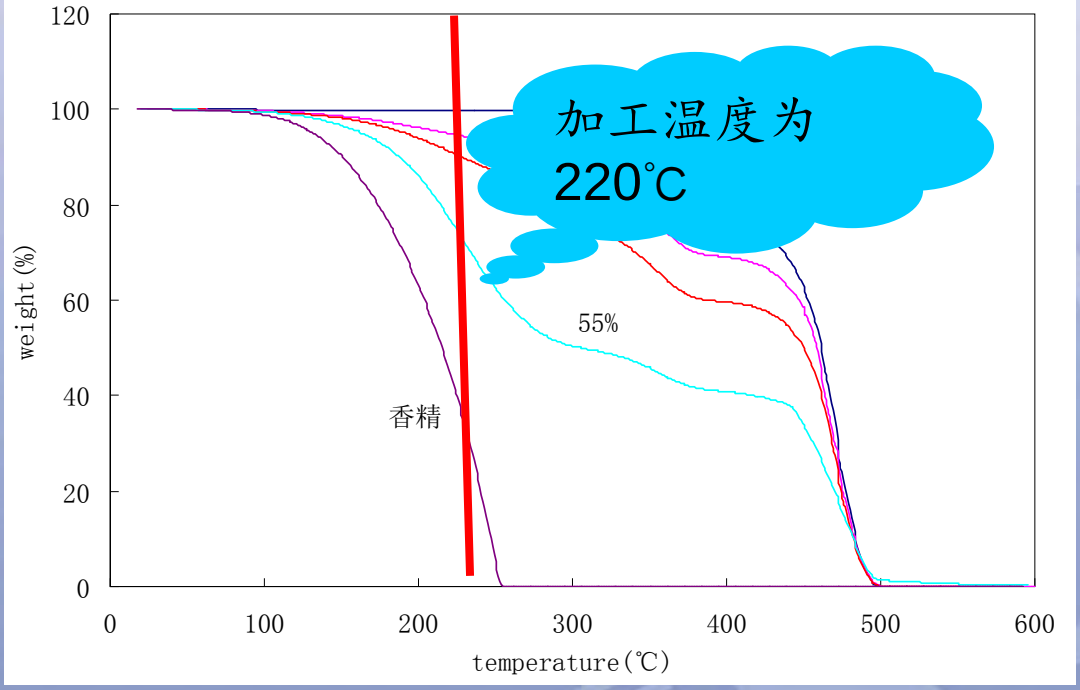


香母粒的制备[1.2.3]

Preparation of fragrant master batch

3. 香母粒的热稳定性

Thermal stability of fragrant masterbatch

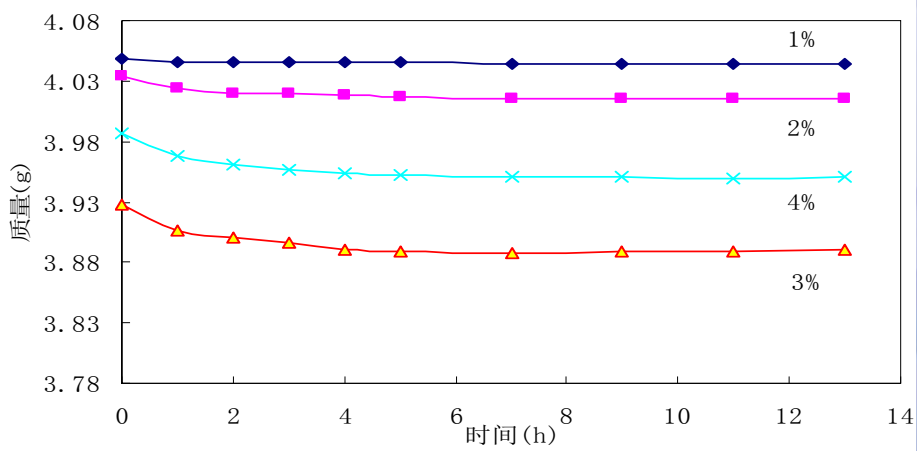


释香草丝的制备[1.2.3]

Preparation of fragrant releasing turf fiber

1. 香草丝的热稳定性

Thermal stability of fragrant turf fiber



随着香母粒用量的提高，草丝在70℃下香精的初始释放量逐渐增大，但当释放量基本不变时，香母粒浓度越高，草丝中的香精残留量越大。这说明香母粒浓度越高，缓释时间越长，缓释性能越好。

释香草丝的制备[1.2.3]

Preparation of fragrant releasing turf fiber

2. 香草丝的缓释性

Fragrant releasing ability of turf fiber

香母粒浓度	缓释时间				
(1%)	1月	2月	4月	6月	8月
2	+++++	++++	++	+	
3	+++++	++++	+++	++	+
4	+++++	+++++	++++	++	+

注：+++++气味很强，++++气味较强，+++气味[illegible]很弱。

最佳用量

释香草丝的制备[1.2.3]

Preparation of fragrant releasing turf fiber

3. 香草丝的力学性能

Mechanical properties of fragrant turf fiber

香母粒质量分数(%)	拉伸强度(N)	断裂伸长率(%)
空白	20.9	118.4
1	18.2	120.3
2	18.1	121.6
3	18.8	122.1
4	17.5	104.6

最佳用量

小结
Conclusion

- 吸附法制备香母粒，温度升高，反应速率加快，但温度超过50℃时，载体发生粘连。不同温度下，达到吸附平衡的时间相差较大，从35h缩短到3h，但平衡吸附量相差却较小。

  Increase the temperature the adsorption reactivity is increased, the equilibrium adsorption capacity is unchanged The best preparation temperature of fragrant masterbatch is below 50 ℃.

- 香母粒的热稳定性明显高于香精，香精浓度为**35%**的香母粒适用于人造草丝的加工工艺中.草丝中含有**2-3%**的香母粒时，缓释性能和力学性能均能达到较高水平

  Fragrant masterbatch is able to undertake the process art for turf fiber.

  The best loading is about 2-3%

阻燃人造草丝的研究
Flame Retardant turf yarn

- 近年来，运动草坪越来越偏重于在室内的铺装，因此，运动草坪的阻燃性能也是急需解决的问题。

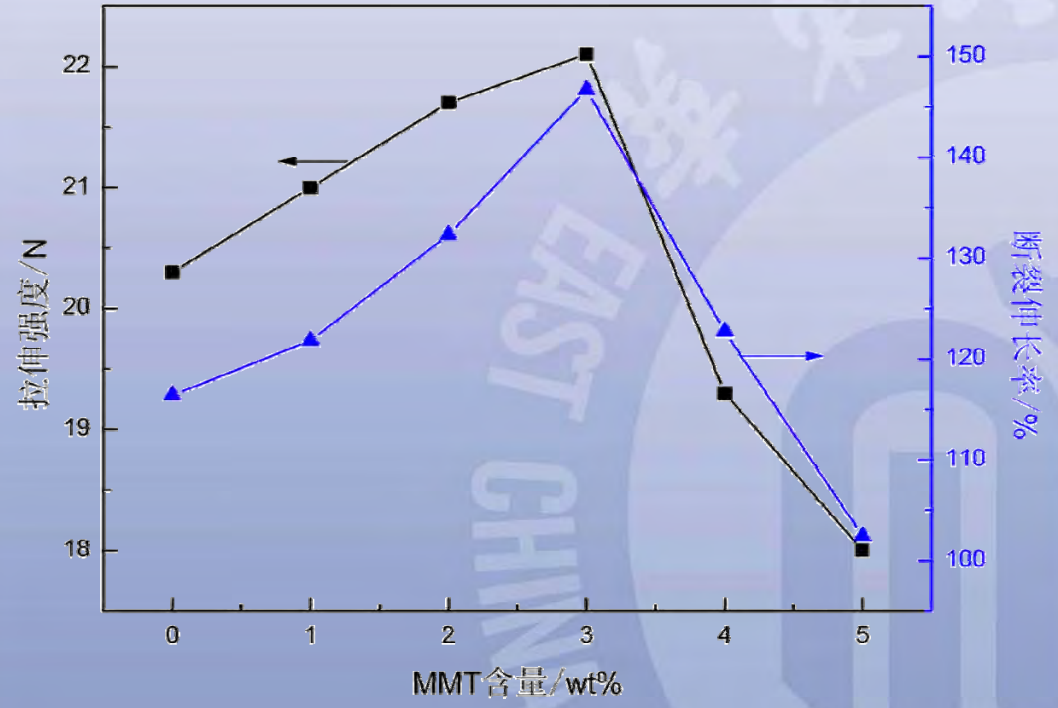
  It is necessary to improve the flame retardant properties of artificial turf used indoor.

- 以十六烷基三甲基溴化铵插层改性后的蒙脱土为填料，将其添加到**LLDPE**中，通过熔融纺丝得到运动草坪纤维，研究蒙脱土的添加量对运动草坪纤维力学性能、磨损性能和阻燃性能的影响。

  Cetyltrimethylammonium bromide(CTAB) interclated montmorillonite (MMT) used as flame retardant additive ,combined with LLDPE to endow artificial turf fiber with good mechanical properties and flame retardant property.

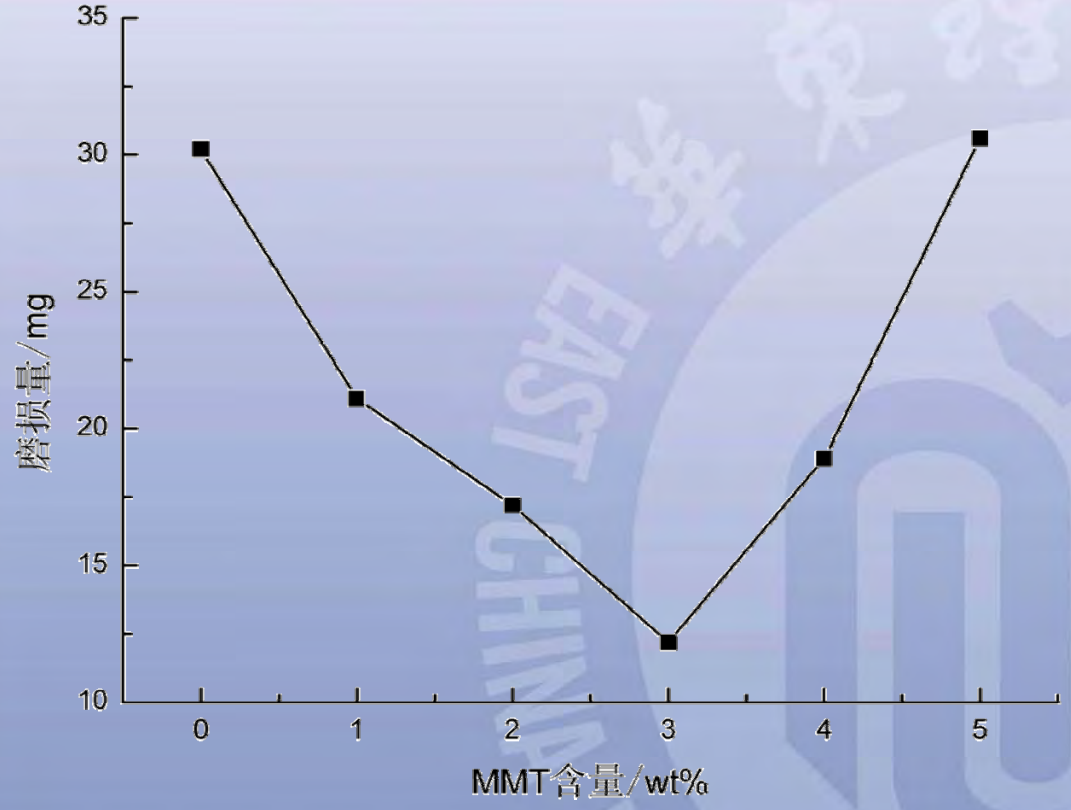
MMT含量对草坪纤维力学性能的影响

Effect of MMT content on mechanical properties of artificial turf fibers



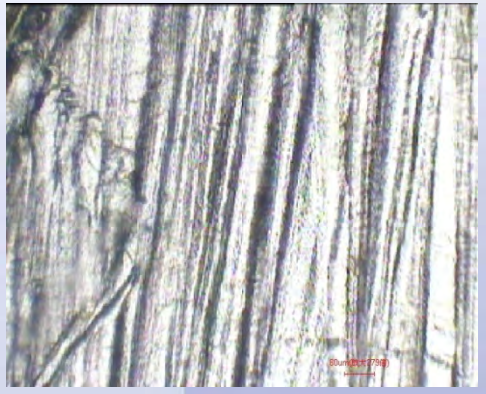
MMT含量对草坪纤维磨损量的影响

Effect of MMT content on wear loss of artificial turf fibers



MMT含量运动草坪纤维磨损表面形貌

Optical microscopes of fiction cross-section of artificial turf fibers with different content of MMT

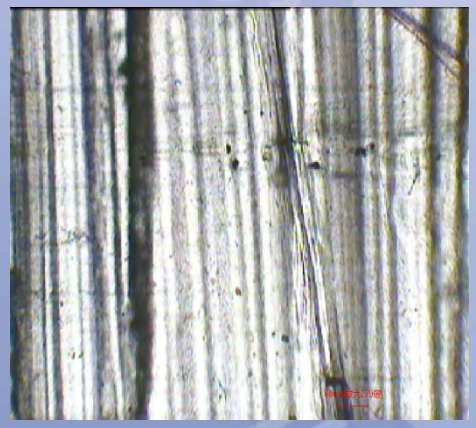


A(0)

B(1wt%)

C(2wt%)

D(3wt%)

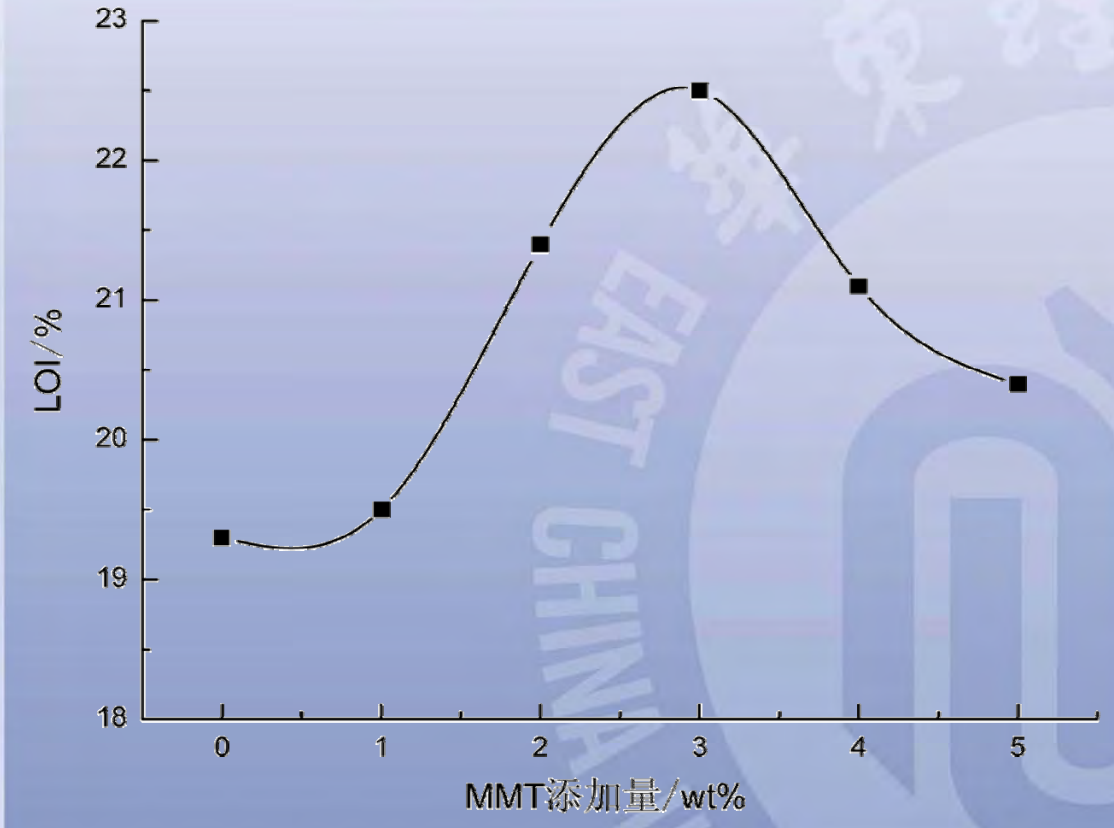


E(4wt%)

F(5wt%)

MMT含量对草坪纤维阻燃性能的影响

Effect of MMT content on flame retardant properties of artificial turf fibers



小结
Conclusion

- 改性蒙脱土提高了运动草坪纤维的力学性能，在添加量为3wt%时，力学性能达到最大值，拉伸强度为22.1N，断裂伸长率达到146.7%，纤维的磨损量最小为12.2mg，分别比未添加蒙脱土时提高了8.9%，26%，和降低了59.6%。

  Adding 3wt% MMT into turf fiber , the tensile strength increased 8.9%,elongation at break increased 26%,and wear loss decreased 59.6% respectively.

- 改性蒙脱土的加入可以提高草坪纤维的阻燃效果。单独加入阻燃剂时的极限%氧指数值为19.3%，而加入3wt%的改性蒙脱土后，极限氧指数值可以达到22.5%。

  Modified MMT also improve the flame retardant properties of turf fiber, the limit oxygen index(LOI) of turf fiber increased from 19.3% to 22.5% with 3wt% MMT.

Thank You !