

Technical Report

Performance tests on

TPV infill for artificial grass surfaces

for

Rosehill Polymers Ltd

Summary

A series of tests have been carried out on *TPV infill for artificial grass surfaces*. This report combines the results of Labosport's reports UK.06-0222B and UK.05-0122. It details the samples tested, describes the tests carried out and the lists the results obtained.

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1 Client

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2 Samples

A sample of infill material for artificial grass was submitted for test. It was designated *TPV infill for artificial grass surfaces*.

3 Test programme

3.1 Sports performance tests

A series of sports performance tests were carried out on an artificial grass football surface incorporating the infill material. The tests were carried out to assess how the surface performs when assessed using the procedures specified in the *FIFA Handbook of Test Methods and Requirements for Artificial Turf Football Surfaces* (March 2005 edition). The artificial grass surfacing systems comprised:

Pile type	Mono-filament
Pile yarn type	Polyethylene
Tuft rate	9,055/m ²
Pile weight	1,640g/m ²
Performance infill	TPV In-Infill Green (0.5 - 2.5mm)
Performance infill weight	12 kg/m ²
Stabilising infill	0.2 – 0.63mm round sand
Stabilising infill weight	8 kg/m ²

Stabilising infill depth	8mm
Shockpad type	2mm to 6mm SBR rubber granules bound together with Flexilon FX1102 binder at an application rate of 10%
Shockpad thickness	nominal 15mm

The artificial grass surface was tested for those properties influenced by the infill within the artificial grass playing surface. These were identified as:

- Ball rebound
- Angle ball rebound (Football Pace)
- Shock Absorption
- Deformation
- Effects of simulated wear

Ball rebound

Ball rebound is a measure of how high a ball bounces when it rebounds from a surface. This property is measured by dropping a football from a vertical height of 2.0m and measuring its rebound from the surface. Results are expressed as an absolute rebound.

Angle ball behaviour

This test measures the change in velocity of a football as a result of it striking the artificial grass surface. The football is fired onto the surface using a pneumatic cannon and its velocity just before and just after the impact is measured using a radar system. The change in velocity is calculated and expressed as a percentage reduction in speed.

Shock absorption

This test measures the ability of a surface to dissipate impact energy and is measured using an artificial athlete that is designed to replicate the loading pattern of an athlete running on the surface. A mass of 20 kg is allowed to fall onto a spherical anvil, which transmits the load via a spring to a test foot resting on the surface. The foot is fitted with a force transducer that enables the peak force during the impact event to be recorded. This peak force is compared with the result obtained on a rigid (concrete) floor, and the percentage force diminution calculated for the artificial grass surface.

Deformation

The degree to which a surface deforms when a player runs on it will influence the stability and fatigue levels experienced by the player. To ensure a surface does not deform excessively this aspect of its construction is also measured using an artificial athlete. The test foot is fitted with displacement transducers that enable the deformation of the surface under dynamic loading to be determined at a standard impact force.

Rotational Resistance

The ability of a player to be able to twist and turn with confidence is a very important aspect of a surface's performance. The property is measured by measuring the torque required to initiate rotational movement in a weighted studded plate resting on the surface.

Stud slide and stud deceleration

The linear frictional properties between the surface and a studded test foot are measured in two ways; the resistance the surface offers to sliding is measured

using a pendulum fitted with a studded foot that is allowed to slide across/through the surface. During the same test the rate of deceleration of the studded foot is recorded.

Water Permeability

To demonstrate the drainage capacity of the surfaces water permeability was measured. This procedure uses a double ring infiltrometer that is sealed to the surface. The outer ring is filled with water to act as a buffer to prevent the lateral flow of water, whilst the time a 30mm head of water takes to drop 20mm in the inner ring is measured.

Test conditions

The sample of artificial grass was tested in the conditions specified in the FIFA test manual. These are a combination of dry, wet and after conditioning to simulate use. Prior to test the sample was conditioned by passing a hand-pulled roller over the test specimen for 50 cycles, as specified in the test manual.

Wet samples were prepared by evenly applying to the test piece a volume of water that thoroughly soaked the specimen. Following wetting the test specimen was allowed to drain for 15 minutes and the tests carried out immediately thereafter. This procedure is specified by FIFA.

Samples conditioned to simulate use were prepared using a Lisport® Wear Machine in accordance with test method FIFA 10/05-01.

To ensure the dynamic properties measured in the test programme were only provided by the artificial grass surfacing system the test specimens were laid

on a concrete test bed. Laying the complete system on some forms of unbound dynamic base may provide enhanced performance.

All tests were made at a standard laboratory temperature of 23 ± 2 °C.

3.2 Resistance to Artificial Weathering

Samples of the infill material were tested for Resistance to Artificial Weathering in accordance with the procedures detailed in FIFA's *Handbook of Test Methods for Football Artificial Turf* (2006 edition).

3.3 The product identification tests for performance infill specified in the FIFA *Handbook of Test Methods for Football Artificial Turf* (2006 edition) were undertaken on a sample of the infill material.

4 Results

4.1 Sports performance tests

Property	Units	Condition	Result	Requirement	
				High level football	Training and community use
Ball rebound	m	Dry	0.78	0.60 - 0.85m	0.60 – 1.0m
		Wet	0.80		
		After simulated use	0.83		
Football Pace	%	Dry	51	45% - 60%	45% - 70%
		Wet	64		
Shock absorption	%	Dry	64	60 – 70%	55% - 70%
		Wet	64		
		After simulated use	62		

Property	Units	Condition	Result	Requirement	
				High level football	Training and community use
Deformation	mm	Dry	8.0	4 – 8mm	4 – 9mm
		Wet	7.0		
		After simulated use	7.0		
Rotational Resistance	Nm	Dry	38	30 – 45Nm	25 – 50Nm
		Wet	41		
		After simulated use	44		
Stud deceleration	g	Dry	3.96	3.0g - 5.5 g	3.0 – 6.0 g
		Wet	3.80		
Stud slide		Dry	143	130 – 210	120 – 220
		Wet	138		
Water permeability	mm/h	-	1564	>180mm/h	>180mm/h

4.2 Resistance to artificial weathering

Property	Test method	Result
Colour Change	FIFA 11	Grey scale 4 – 5
Appearance	EN 14836	No change

4.3 Product identification

Tests	Tests Method	Results
Particle size of rubber (mm)	EN 933-1	1.0mm – 2.5mm See graph below
Bulk density of rubber (g/cm ³)	EN 13043	0.84
Particle shape of rubber	prEN 14955	Angular See picture below

Tests	Tests Method	Results
Residual compression & change in appearance	FIFA 12	17 % no change
Thermo-gravimetric analysis	% organic	37 %
	inorganic	63%



Figure 1 - granule shape

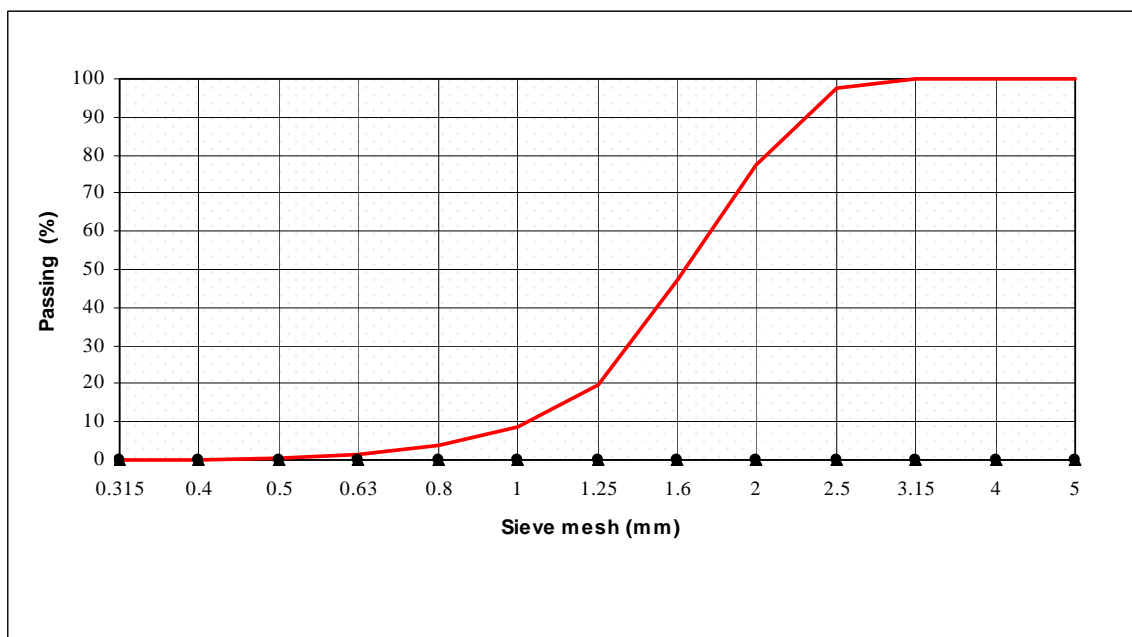


Figure 2 - grading analysis

5 Conclusions

5.1 Sports performance tests

The results obtained have shown that artificial grass surface comprising a mono-filament artificial grass carpet infilled with 12kg/m² of TPV In-Infill Green (0.5 - 2.5mm), 8kg/m² of stabilising infill and laid over a 22mm in-situ rubber shockpad was able to provide levels of performance that fell within the ranges typically specified for artificial grass pitches used for professional and international football.

5.2 Artificial weathering requirements

The results show the sample of *TPV infill for artificial grass surfaces* satisfies the artificial weathering requirements for polymeric infill materials commonly specified for artificial grass surfaces used for professional and community football.

Reported by

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