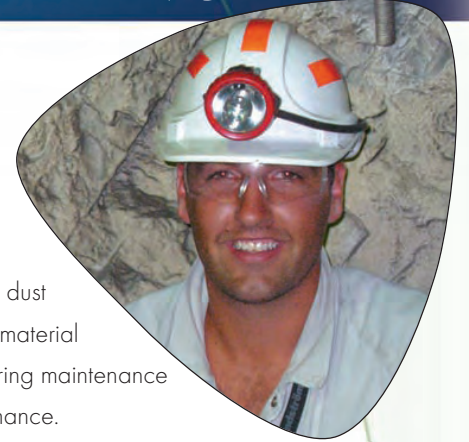


NEW GENERATION CONVEYOR SKIRTING

For decades rubber has been used for skirting the transfer points of conveyors worldwide. Styrene-Butadiene Rubber's (SBR) high wear resistance, combined with its low cost, has made it a logical choice to date. However, the bulk material handling industry is seeing dramatic changes and innovations in the area of highly abrasive-resistant skirting material. These innovations are the result of changes in plant operating environments, including higher belt speeds, ongoing reductions in employees, and a skills shortage in the market. Today a variation of the high performance polyurethane is now the most economical way of skirting rubber conveyor belts. This paper analyses the coefficient of friction, wear resistance and tensile strength comparing SBR rubber, natural rubber, and polyurethane.

INTRODUCTION

Maximizing production rates, reducing maintenance expense and maintaining the safety of company employees are important priorities for the bulk material handling industry. Skirting is an important solution for reducing the dust from conveyor transfer points. Finding a skirting material that helps maintain production rates while lowering maintenance time and cost is also critical to a plant's performance.



One solution to this problem is to change the skirting material on bulk material handling conveyors to an efficient, wear resistant, dust-reducing system. Changing out or adjusting skirting on conveyors is a costly job for many bulk material plants across the globe. Administration time required to change or adjust skirting can be extreme. Also a major problem for many plants is belt tracking, which is often caused by material escaping from worn skirts. Using a material that will last longer can reduce costly down time associated with changing or adjusting the skirting material for optimum performance.

With ever increasing production rates there is a greater requirement for plants to run 24 hours a day, 7 days a week. For example, the power generation industry requires long run times between short scheduled maintenance windows. In many cases SBR rubber is not lasting between maintenance windows, resulting in spillage, airborne dust, tracking issues, premature failure of idlers and belt damage, to name a few of the potential problems.

There are many high wear-resistant materials which can be used in plants to combat wear including ceramics, and heat-treated or hardened steels. However these materials can be unforgiving when used in skirting applications if the system is installed too close to or contacting the conveyor belt surface.

The misunderstanding within the industry in distinguishing the difference between new and traditional materials (polyurethanes and polyethylenes, ultra high molecular weight polyethylene (UHMWPE), natural rubber, etc.) to skirt transfer points prompted us to research the most economical and belt-friendly skirting material available. Ruling out materials that were hard and or abrasive we chose four materials to analyse:

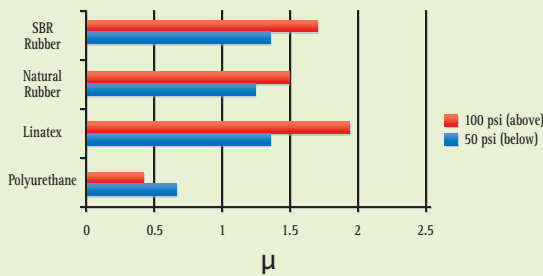
- SBR Rubber 60 DURO SHORE A (most commonly used)
- Natural Rubber 60 DURO SHORE A
- Linatex Natural Rubber 60 DURO SHORE A
- Argonics Polyurethane 69 DURO SHORE A

FRICITION TEST

μ = tangent stress / normal stress

Normal Stress (psi)	Polyurethane	Linatex	Natural Rubber	SBR Rubber
50	0.69	1.38	1.29	1.38
100	0.43	1.93	1.5	1.72
Average (μ)	0.56	1.655	1.395	1.55

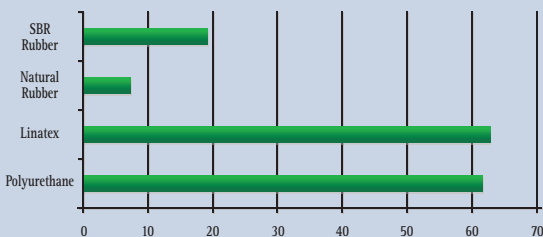
Coefficient of Friction μ



ABRASIVE INDEX

ABRASIVE INDEX	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
% unchanged	62	63	7	19

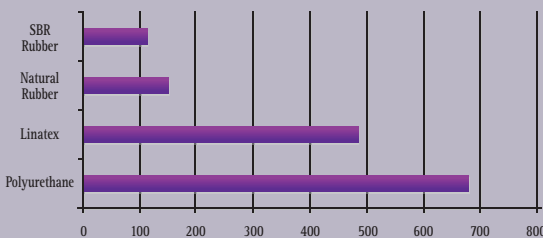
Abrasive Index % Unchanged



TENSILE STRENGTH

TENSILE STRENGTH	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
Break Load (N)	676	485	151	125

Break Load (N)



TEST RESULTS

Friction

The most important of the three tests is the skirting materials coefficient of friction value, due to its potential to transfer heat along skirted areas, causing premature belt damage. In this case the lower the value μ , the better.

- The polyurethane sample had the lowest friction value in all 4 tests.
- The friction value of polyurethane is 64% lower than SBR rubber.

The 200 and 300 psi test data was not graphed, as the Linatex natural rubber samples peeled off twice due to excessive friction rates during testing.

Reducing friction between skirting and the conveyor belt surface is arguably the most important step in eliminating excessive skirting wear and belt damage. Conveyor belts are often replaced solely due to the skirting wearing a groove completely through the belt's top cover exposing the ply carcass which results in tearing, spillage, belt tracking issues, etc.

Some rubber skirting is porous which allows dust to adhere to the contact surface forming abrasive grit, which then wears a groove in the conveyor belt.

Polyurethane being inherently non porous restricts the amount of dust being trapped under the skirt's surface.

- Rubber's high friction = high abrasion and belt damage.
- Polyurethane's low friction and non porosity = less abrasion and belt damage.

Abrasive Resistance

Test Method: NBS Abrasion (ASTM D1630), Chemtura laboratory test facility, USA

The graph to the left shows that Linatex natural rubber, whilst achieving a high wear resistance, is not preferred as a conveyor skirting material due to its high friction coefficient. Linatex was not used in a case study for this reason.

The graph shows the polyurethane sample 326% more resistant to wear than SBR rubber.

This should not be confused with the true wear resistance of the materials tested due to the field situation allowing for friction between the belt and the skirting.

Tensile Strength

Test Method: Extensometer (strain gauge)

The graph to the left shows polyurethane having the highest tensile strength.

RESULTS COMPARED	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
Abrasion % of original	62	63	7	19
Friction (μ)	0.56	1.655	1.395	1.55
Tensile Strength (N)	676	485	151	125

CASE STUDY

Gladstone Operating Port Authority, Gladstone, QLD, AUS

A trial was conducted at the RG Tanna Coal Terminal to properly test the performance of polyurethane against the most commonly used skirting material, SBR rubber. The conveyor transfer point from the wharf conveyor to the ship loader was chosen as the test area.

Conveyor 6B-6BX Transfer point specifications:

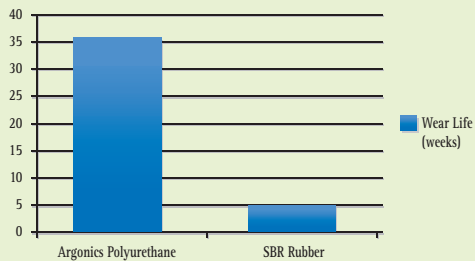
- 6000 TPH
- 5.2 m/s (1023 fpm)
- 2400mm rubber conveyor belt width (94.5 in.)

The polyurethane skirting was installed in Sept 2008 and is still running as of June 2009

Reported: 11 June 2009 only 1.5mm wear present.

SKIRTING MATERIAL	Argonics Polyurethane	SBR Rubber
Wear Life (weeks)	36	5

RG TANNA COAL TERMINAL QLD



CONCLUSIONS

High wear resistance combined with a low coefficient of friction is the ideal combination for a skirting material. Polyurethane produced the best results in the laboratory and field tests. Though the abrasive test results show polyurethane is 3-4 times more abrasive resistant than SBR rubber, once the friction factor was added in a real world scenario we concluded that the polyurethane lasted 6-10 times longer than SBR rubber. This difference in wear rates is due to the polyurethane's very low friction value. The abrasive resistance test ASTM D1630 simulates abrasion by means of grit and not the contact between the conveyor belts.

Further case studies have showed that as the belt speed increased, the wear rate of SBR rubber increased exponentially. However polyurethane remained more constant due to the lower friction value.

The table below summarises the suitability of each tested material.

	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
High wear resistance?	YES	YES	NO	NO
Low Friction?	YES	NO	NO	NO
Suitable for high belt speed?	YES	NO	NO	NO

ACKNOWLEDGEMENTS

The author would like to thank the Gladstone Port Authority (RG Tanna Coal Terminal) for making themselves available for the trial to take place on site.

NOMENCLATURE

TPH	Tonnes per hour
N	Newtons
Psi	Pounds per square inch
μ	Coefficient of friction
SBR	Styrene-Butadiene Rubber
m/s	Meters per second
ASTM	American Society for Testing and Materials

REFERENCES

- [1] Greg Case, Gladstone Port Authority, Gladstone, QLD, AUS
- [2] Reglin Suppliers, Kilsyth, VIC, AUS
- [3] Chemtura, Middlebury, Connecticut, USA
- [4] Neil Kinder, Kinder and Co Pty Ltd, Braeside, VIC, AUS

NEW GENERATION
CONVEYOR SKIRTING



ARGONICS
ENGINEERED POLYURETHANE

The Argonics Nested Triangle logo is a trademark of Argonics, Inc.

520 9th Street • Gwinn, MI 49841

906.226.9747 • 800.991.2746

fax: 906.226.9779 • information@argonics.com