



Tubeless Tape

Performance Validation

Application note for wheel manufacturers, bicycle brands and performance-oriented cyclists

Tubeless stands for modern cycling with more comfort, more performance and better puncture protection. But where innovation meets enthusiasm, new challenges arise: to this day there is no uniform test or validation specification for tubeless rim tapes. This leaves both product selection and application on uncertain ground.

This is where MRR Bike & Outdoor comes in. This application note documents a structured comparison of commercially available tubeless rim tapes using recognised test methods, its validation under real riding conditions, and the resulting recommendations for the industrial application process.

MRR Bike & Outdoor stands for German engineering, technical precision and a genuine passion for cycling. From the adhesive to the finished product, everything comes from a single source – *Made in Germany*.

We develop and manufacture within a German industrial group that covers the entire value chain: adhesive formulation, tape manufacturing, converting and application engineering – combined with dedicated product know-how for the bike and outdoor sector.

Contents

- 01** Technical comparison of commercially available products
- 02** Application testing
- 03** Findings and recommendations

Executive summary

Six commercially available tubeless rim tapes – including products from Tesa, Muc-Off and Schwalbe as well as two tapes from MRR Bike & Outdoor – were analysed chemically for composition and tested physically for adhesion, tensile strength and puncture resistance. The basis was the recognised AFERA test methods, supplemented by a needle test we developed ourselves.

- **No tape was best in every discipline.** The differences show up primarily in bonding behaviour and puncture resistance.
- **The backing film determines conformability.** MOPP, polyimide and PET co-polymer behave very differently on curved rim profiles.
- **Field validation to the point of failure.** In an inflation test on a DT Swiss E1900 with a Schwalbe Hans Dampf, the valve failed at approximately 8.5 bar – the rim tape remained undamaged.
- **Application is a lever in its own right.** Web tension, number of wraps and edge quality at spoke and valve holes measurably affect the result.

Note on scope: The laboratory data describe material properties under standardised conditions. Real-world factors such as rim profile, mounting, tyre pressure and riding load can change actual performance. The results therefore serve as guidance and do not replace an application-specific qualification test.

01

TECHNICAL COMPARISON OF COMMERCIALY AVAILABLE PRODUCTS

Six commercially available products from Tesa, Muc-Off, Schwalbe and MRR Bike & Outdoor were analysed chemically for composition and tested physically for adhesion, tensile strength and puncture resistance in accordance with the recognised AFERA test methods, supplemented by a needle test developed in-house. The results are compared below and interpreted with reference to expected in-use performance.

Backing material and thickness

Given the wide variety of rim profiles and the high sealing requirements, the material must be conformable and at the same time withstand high mechanical loads.

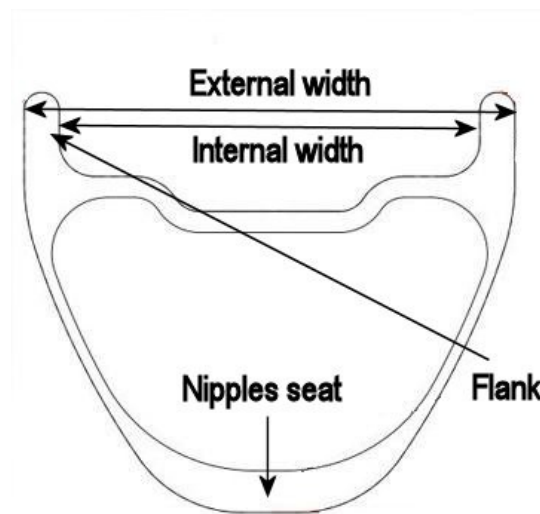


Figure 1: rim profile

The backing materials of the tapes examined were MOPP, polyimide and PET co-polymer, with the following basic characteristics:

- **MOPP films** at around 100 μm are, due to their stiffness, less flexible and less conformable on complex or strongly curved rim profiles.
- **Polyimide films** at approx. 70 μm offer higher temperature and flexural strength combined with good flexibility, and are better suited to demanding tubeless tapes that must adapt reliably to different rim geometries.
- **PET co-polymer** at approx. 55 μm is very thin and flexible, but falls behind polyimide in terms of temperature and long-term stability, making it a limited choice as a backing layer for dynamic tubeless applications.

Tensile strength and elongation

Because users want the best possible sealing effect, rim tapes are applied under high tension. The purpose of this tension is to bond the tape without wrinkles and so prevent air loss. The most critical point when applying a tubeless tape is the area around the valve hole. Ideal sealing calls for high tensile strength combined with low elongation.



Figure 2: valve hole

Identified backing material	Tensile strength	Elongation
MOPP (117 µm)	Very high	Low (typically < 50 %)
Polyimide (77 µm)	High	Medium to high
PET co-polymer (55 µm)	Medium	Medium to high

What this means for a tubeless tape

- **MOPP** barely stretches and withstands high pressure, but is stiffer and less adaptable to tight radii.
- **Polyimide** withstands pressure and temperature while remaining more deformable, adapting well to complex rim profiles.
- **PET co-polymer** is very thin and flexible, but mechanically weaker and less robust under sustained load.

Bonding properties

The quality of a bond depends on the material and surface properties, the cleanliness of the surfaces to be bonded, and the composition and thickness of the adhesive. Steel, aluminium and carbon have broadly similar surface energies and bond without difficulty. Bond strength, temperature stability and residue-free removability depend on adhesive composition and coat weight, and rest on a physical interaction described by Van der Waals forces.



Figure 3: why does a tape stick?

Adhesive system	Strengths	Limitations
Silicone	Extremely temperature-resistant, very flexible, chemically stable	Lower bond strength, optimised more for silicone surfaces
Natural rubber	Very high initial tack, tolerant of uneven surfaces	Better suited to short- and medium-term applications
Acrylic	Very good long-term and UV resistance, universal adhesion	Lower instant tack, somewhat more brittle at low temperatures

Silicone adhesive systems offer high temperature resistance, flexibility and good chemical stability, but tend to deliver lower bond strength. Natural rubber systems excel in instant tack. Acrylic adhesive systems represent the balanced solution for durable applications.

Puncture resistance

Once the tubeless tape has been applied as well as possible, puncture resistance becomes the decisive parameter for safe riding at the limit. Conditions vary widely depending on the rim used and the riding pressure. For this reason a modified puncture test procedure was applied, which was subsequently validated by destructive inflation tests.

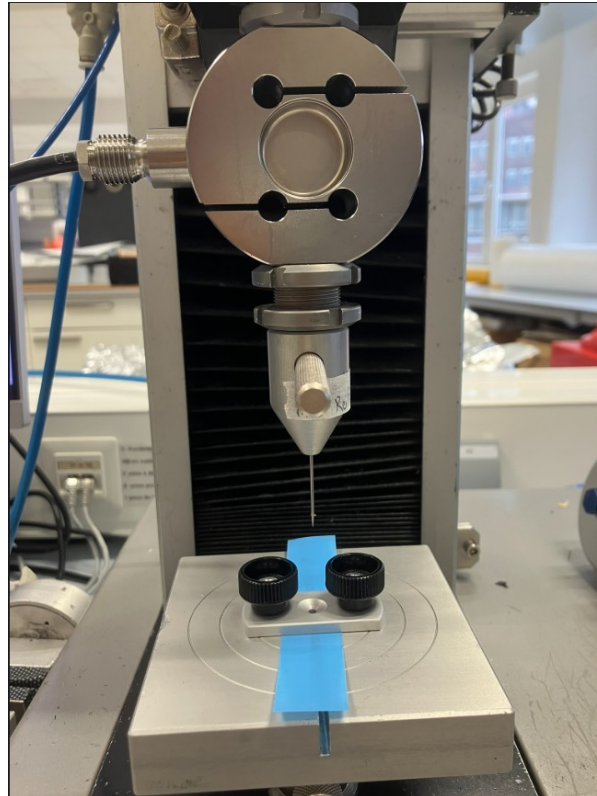


Figure 4: puncture test

Puncture behaviour

The result of the puncture test depends on the thickness of the backing film: the thicker the film, the higher the force required to penetrate the tape. In terms of material, the following basic characteristics apply:

- **Polyimide films** offer very high puncture resistance.
- **MOPP films** achieve medium point resistance at greater thickness, which can decrease further under elevated web tension.
- **PET co-polymer films** provide little meaningful needle stability.

Measured values

All tubeless tapes were subjected to identical tests. No single tape ranked best across all measurements. Clear differences emerge in bonding behaviour and puncture resistance. The products already established in the consumer segment performed worst in bonding and puncture resistance under normal conditions.

Beschreibung:		WM-0100 MOPP-Tape Hersteller			WM-0282 MOPP-Tape Hersteller			WM-0280 tubeless rim tape Vermarkter			WM-0281 tubeless rim tape Vermarkter			MRR Bike&Outdoor MOPP-Tape blau			MRR Bike&Outdoor MOPP-Tape schwarz			
Abmessungen Breite x Länge		25 mm x 66 m			30 mm x 66 m			25 mm x 10 m			25 mm x 10 m			20 mm x 66 m			25 mm x 66 m			
Material Träger		MOPP			MOPP			Polyimid			PET-Copolymer			MOPP			MOPP			
Dicke Träger [mm]		0,117	0,115	0,117	0,115	0,119	0,118	0,076	0,077	0,078	0,055	0,055	0,056	0,107	0,112	0,109	0,090	0,089	0,091	
		0,116			0,117			0,077			0,055			0,109			0,090			
Reißkraft Träger [N/cm]		336	319	279	287	291	298	106	128	116	106	101	108	271	253	275	212	200	221	
		311			292			117			105			266,333			210,900			
Reißdehnung Träger [%]		23	28	35	29	25	24	83	108	98	134	104	136	55	55	74	45	44	68	
		29			26			96			124			61			52			
Klebstoff		Naturkautschuk			Naturkautschuk			Silikonklebstoff			Acrylat			Naturkautschuk			Naturkautschuk			
Klebkraft [N/cm]																				
Tack	Sofort	4,8	5,4	5,2	4,1	5,0	5,4	1,2	0,8	0,9	1,7	1,1	0,8	4,8	3,6	2,3	4,3	4,2	4,2	
		5,1			4,8			1,0			1,2			3,6			4,2			
Ad/Stahl	Sofort	4,8	5,2	5,5	7,1	6,5	5,8	2,9	2,6	2,4	8,2	8,7	7,2	6,9	6,6	5,0	5,1	5,0	4,1	
		5,1			6,5			2,6			8,0			6,2			4,8			
	Nach 24 h	5,5	5,7	5,5	7,6	7,2	6,5	3,4	3,4	3,2	11,2	11,2	10,4	7,2	6,9	6,8	5,5	5,4	5,3	
		5,6			7,1			3,3			10,9			7,0			5,4			
Durchstoßtest in Anl. an PSA-Test - Nadeldurchmesser: 0,14-0,16 mm - Traversengeschw. 100 mm/min - Klebstoffseite nach oben																				
Durchstoßkraft	[N]					3,2	3,4	2,8	2,3	2,2	2,2	1,5	1,3	1,4	2,4	2,4	2,2	1,5	1,9	2,0
	Anlieferung mit Probenhalter					3,1			2,2			1,4			2,3			1,8		
	[N]					3,0	3,2	3,4	2,9	2,9	2,8	2,6	2,7	2,9	4,1	4,1	4,4	3,9	3,8	3,8
	Anlieferung ohne Probenhalter					3,2			2,9			2,7			4,2			3,8		
	[N]					2,9	2,9	2,9	3,2	3,0	3,4	3,0	3,1	2,9	4,1	3,9	4,0	2,3	2,4	2,3
	Recken mit 20 N					2,9			3,2			3,0			4,0			2,3		

Table 1: measured properties

02

APPLICATION TESTING

The laboratory results for adhesion, tensile strength and puncture resistance only indicate a direction for how the films and adhesive systems will behave on a bicycle tyre. Real conditions such as rim profile, mounting, tyre pressure and riding load can significantly affect performance. The test data therefore serve as guidance rather than as a direct one-to-one transfer to riding practice.

To validate the test results, a tubeless system consisting of a DT Swiss E1900 wheel, a DT Swiss rim tape and a Schwalbe Hans Dampf tyre was compared against the MRR Bike & Outdoor tubeless rim tape (black).



Figure 5: quick adapter



Figure 6: test wheel E1900 + Hans Dampf

Method

1. The rim tapes were applied using the Park Tool quick adapter developed by MRR Bike & Outdoor, wrapped 1.5 times with a double layer at the valve hole.
2. The Schwalbe Hans Dampf is specified for a pressure of 1.2 to a maximum of 3.5 bar. Other manufacturers such as Newmen state a maximum of 8.5 bar for rim widths < 25 mm and 6.7 bar for > 25 mm.
3. Using a compressor, the tyre was first inflated to 6.5 bar.
4. After reaching this pressure the tyre was observed for several minutes and then inflated further with a floor pump until failure.

Observation

At a tyre pressure of approximately 8.5 bar the valve burst and the tyre came off the rim. The rim tape showed no damage whatsoever.

The test series supports the conclusion that the MRR Bike & Outdoor tubeless rim tape has a higher strength than the valve used.



Figure 7: rim tape after tyre blow-off



Figure 8: ruptured valve

03

FINDINGS AND RECOMMENDATIONS

Findings

The test series produced the following key findings:

1. The MRR Bike & Outdoor tubeless rim tape at 90 µm bonds well and can be removed again without residue.
2. The MOPP film reliably withstands pressures of 6.5 bar.
3. Under high web tension, puncture resistance decreases compared with thicker MOPP films.

Recommendations for industrial application

1. During industrial application of the rim tape, web tension must be controlled and over-stretching prevented.
2. For tyre pressures above 6.5 bar, a double wrap is recommended.
3. Spoke and valve holes must be free of swarf and sharp edges.

Validity of these statements: The laboratory values were determined under standardised test conditions. The destructive inflation test was carried out on one defined wheel and tyre combination and is not to be understood as a statistically validated fatigue-strength statement. For different rim profiles, tyres and operating conditions we recommend an application-specific qualification test, which we are glad to run jointly.



About MRR Bike & Outdoor

MRR Bike & Outdoor develops and manufactures rim tapes and tubeless systems – from the adhesive to the finished product from a single source, Made in Germany.

We operate within a German industrial group that holds every stage of the value chain in-house: adhesive formulation, tape manufacturing, converting and application engineering. This means short internal routes, a European supply chain, and the ability to engineer backing film, adhesive and width for a specific rim profile rather than converting off-the-shelf stock.

What we offer manufacturers

- Backing film, adhesive system and width engineered for your specific rim profile
 - Sample supply and joint qualification testing
 - Documented application recommendations for series assembly
 - Converting in series volumes from German production
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