NANOVEA

RUBBER TREAD CONTOUR MEASUREMENT

USING 3D OPTICAL PROFILER

Prepared by

ANDREA HERRMANN

INTRODUCTION

Like all materials, rubber's coefficient of friction is related in part to its surface roughness. In vehicle tire applications, traction with the road is very important. Surface roughness and the tire's treads both play a role in this. In this study, the rubber surface and tread's roughness and dimensions are analyzed.

*** THE SAMPLE**

IMPORTANCE

OF 3D NON-CONTACT PROFILOMETRY

FOR RUBBER STUDIES

Unlike other techniques such as touch probes or interferometry, ***NANOVEA***'s 3D Non-Contact Optical Profilers use axial chromatism to measure nearly any surface.

The Profiler system's open staging allows for a wide variety of sample sizes and requires zero sample preparation. Nano through macro range features can be detected during a single scan with zero influence from sample reflectivity or absorption. Plus, these profilers have the advanced ability to measure high surface angles without requiring software manipulation of results.

Easily measure any material: transparent, opaque, specular, diffusive, polished, rough etc. The measurement technique of the ***NANOVEA*** 3D Non-Contact Profilers provides an ideal, broad and user friendly capability to maximize surface studies along with the benefits of combined 2D & 3D capability.

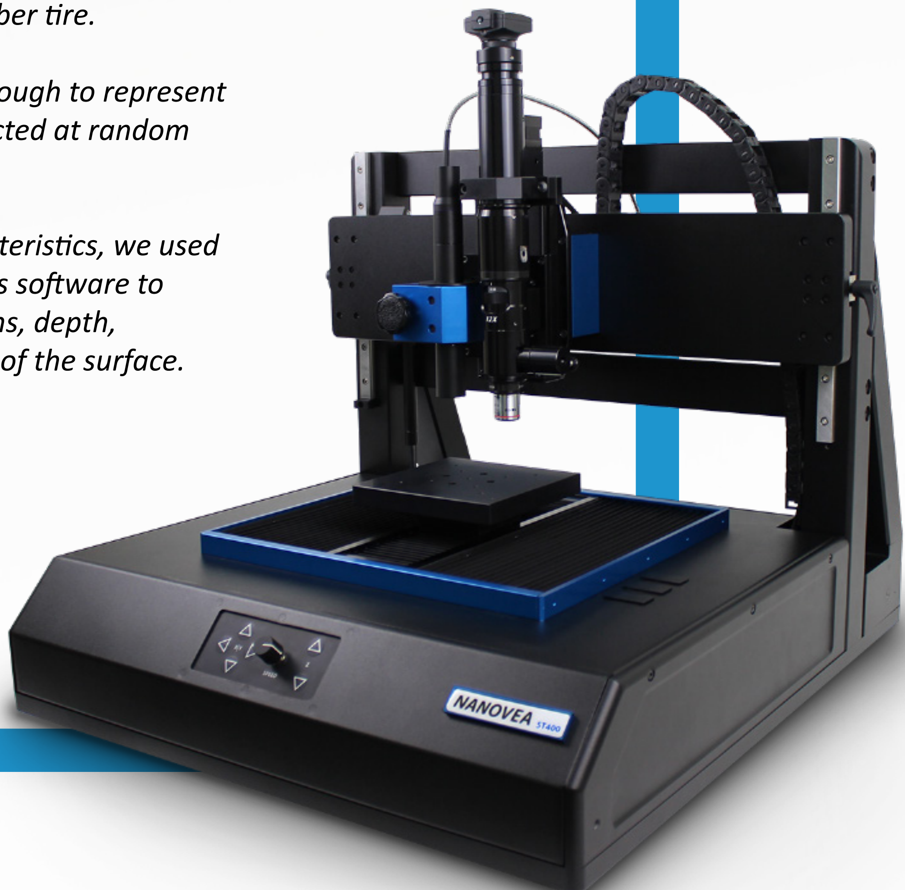
MEASUREMENT OBJECTIVE

*In this application, we showcase the **NANOVEA** ST400, a 3D Non-Contact Optical Profiler measuring the surface and treads of a rubber tire.*

A sample surface area large enough to represent the entire tire surface was selected at random for this study.

*To quantify the rubber's characteristics, we used the **NANOVEA** Ultra 3D analysis software to measure the contour dimensions, depth, roughness and developed area of the surface.*

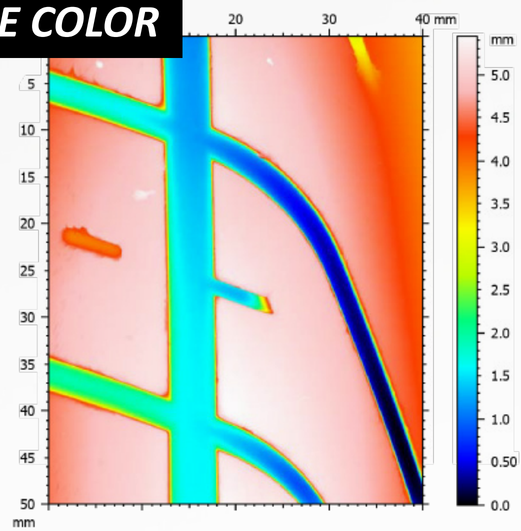
NANOVEA
ST400



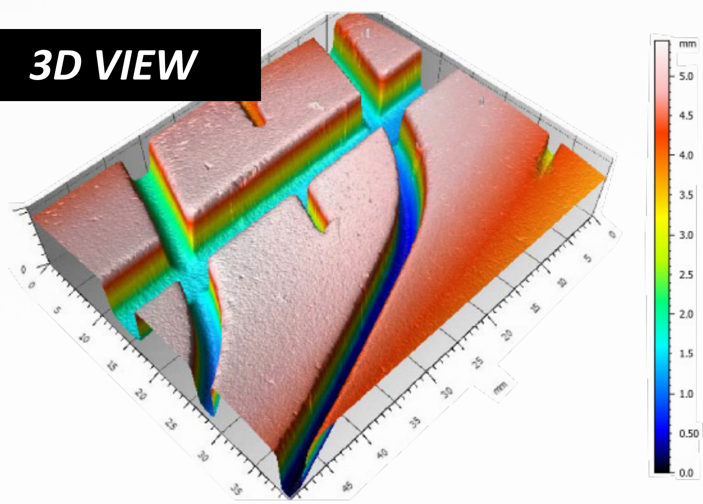
ANALYSIS: TIRE TREAD

The 3D View and False Color View of the treads show the value of mapping 3D surface designs. It provides users a straightforward tool to directly observe the size and shape of the treads from different angles. The Advanced Contour Analysis and Step Height Analysis are both extremely powerful tools for measuring precise dimensions of sample shapes and design

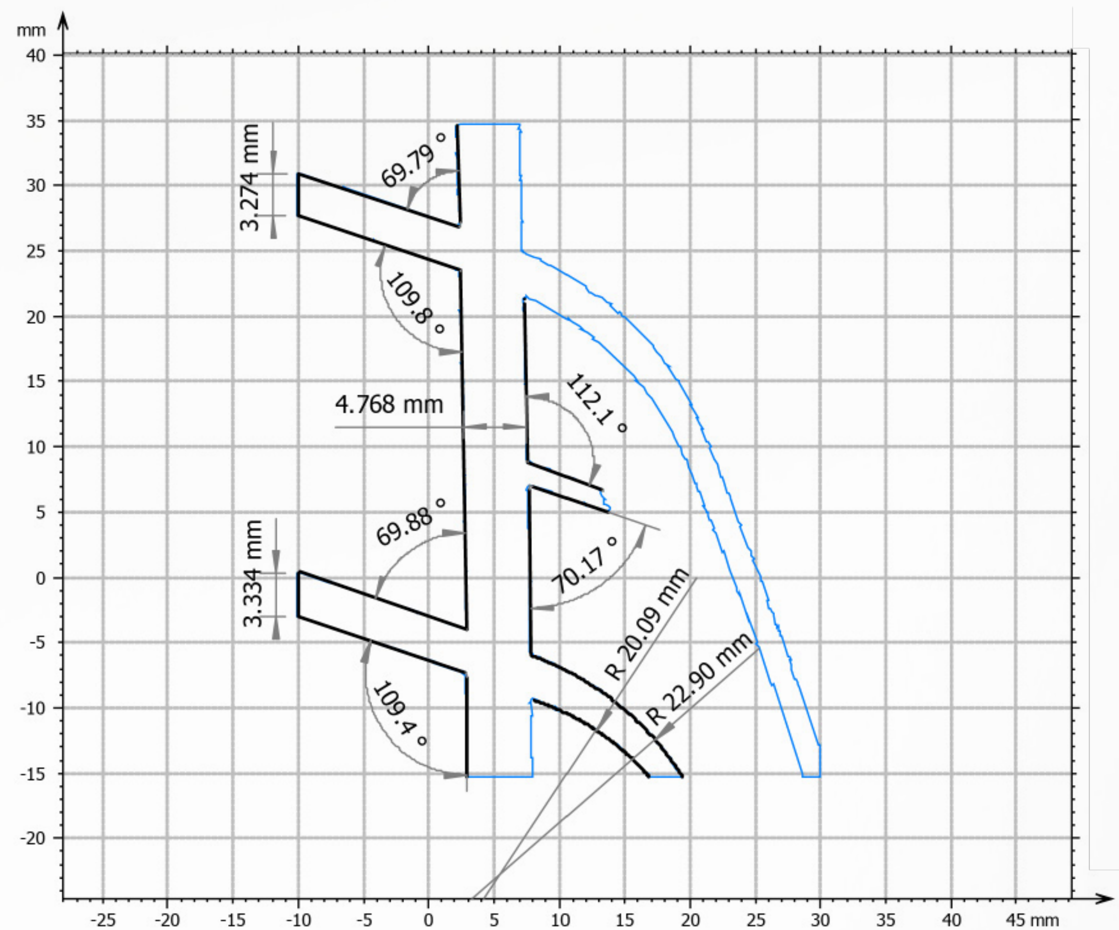
FALSE COLOR



3D VIEW

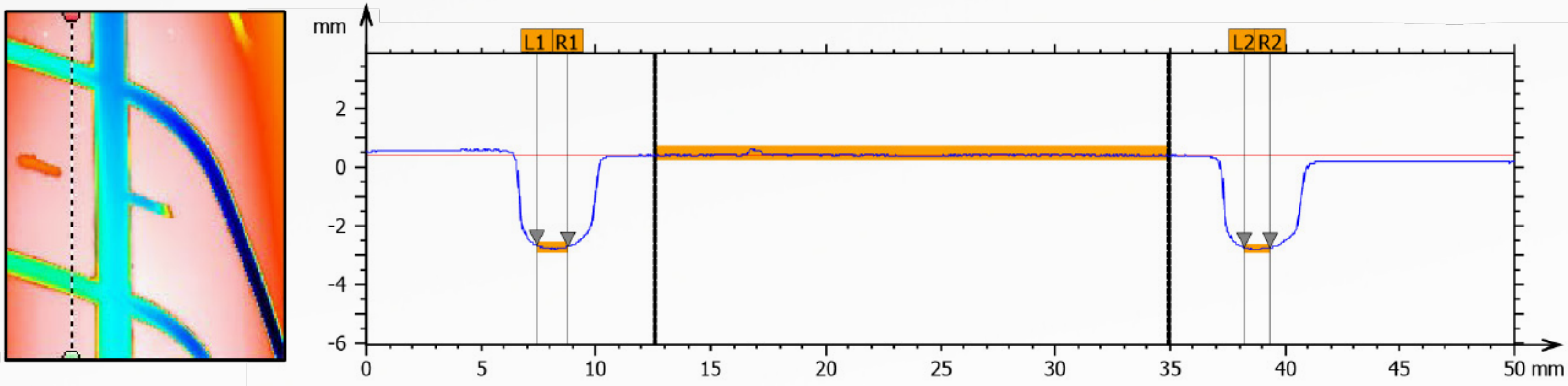


ADVANCED CONTOUR ANALYSIS

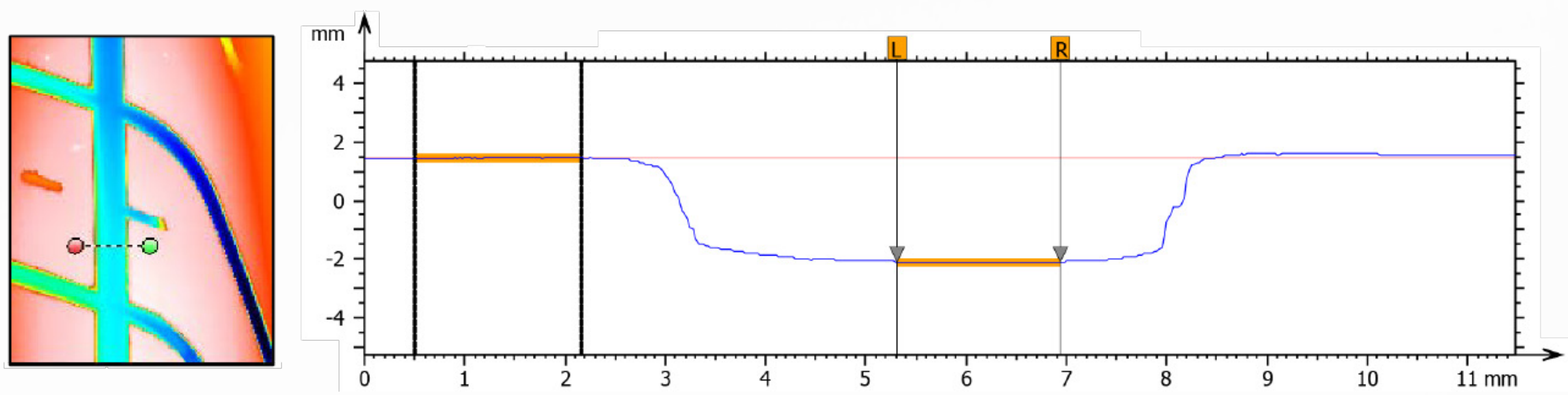


STEP HEIGHT ANALYSIS

	Step 1	Step 2
Maximum height	3.228 mm	3.235 mm
Mean height	3.182 mm	3.206 mm



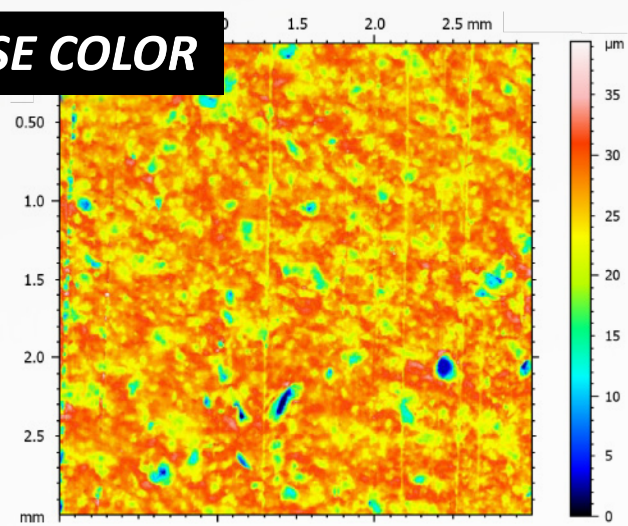
	Step 1
Maximum height	3.574 mm
Mean height	3.553 mm



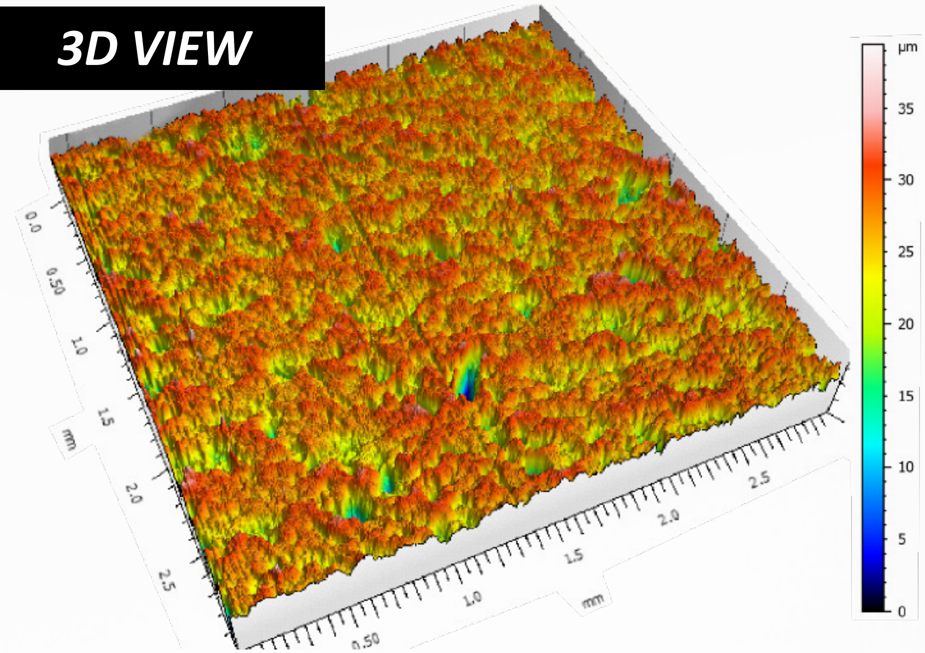
ANALYSIS: RUBBER SURFACE

The rubber surface can be quantified in numerous ways using built-in software tools as shown in the following figures as examples. It can be observed that the surface roughness is 2.688 µm, and the developed area vs. projected area is 9.410 mm² vs. 8.997 mm². This information allows us to examine the relationship between surface finish and the traction of different rubber formulations or even rubber with varying degrees of surface wear.

FALSE COLOR



3D VIEW



ISO 25178

Height Parameters		
Sq	3.657 µm	Root-mean-square height
Ssk	-1.60	Skewness
Sku	7.908	Kurtosis
Sp	13.35 µm	Maximum peak height
Sv	26.10 µm	Maximum pit height
Sz	39.45 µm	Maximum height
Sa	2.688 µm	Arithmetic mean height

Other 3D Parameters

Miscellaneous	
Spar	8.997 mm²
Sdar	9.410 mm²

CONCLUSION

In this application, we have shown how the ***NANOVEA*** 3D Non-Contact Optical Profiler can precisely characterize the surface roughness and tread dimensions of rubber.

The data shows a surface roughness of 2.69 µm and a developed area of 9.41 mm^2 with a projected area of 9 mm^2. Various dimensions and radii of the rubber treads were measured as well.

The information presented in this study can be used to compare the performance of rubber tires with different tread designs, formulations, or varying degrees of wear. The data shown here represents only a portion of the calculations available in the Ultra 3D analysis software.

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