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www.nanovea.com
info@nanovea.com
euro@nanovea.com
mexinfo@nanovea.com

DIMENSIONAL AND SURFACE FINISH

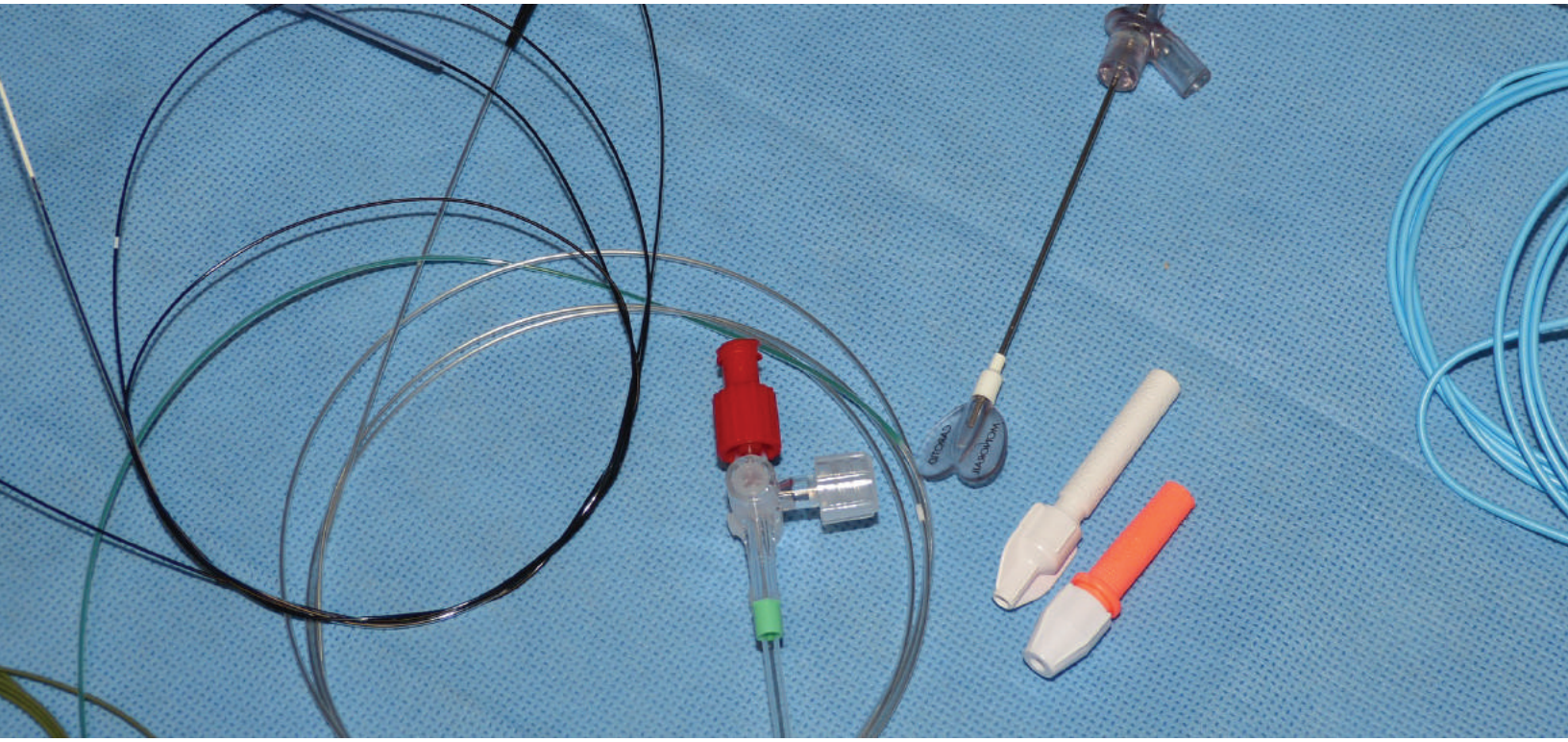
OF

POLYMERIC TUBES

Prepared by

Duanjie Li and Pierre Leroux

www.nanovea.com
info@nanovea.com
euro@nanovea.com
mexinfo@nanovea.com



Introduction

Tubes made from polymeric material are commonly used in many industries ranging from automotive, medical, electrical, and many other categories. In this study, medical catheters made of different polymeric materials were studied using the Nanovea 3D Non-Contact Profilometer to measure surface roughness, morphology, and dimensions. Surface roughness is crucial for catheters as many problems with catheters, including infection, physical trauma, and inflammation can be linked with the catheter surface. Mechanical properties, such as coefficient of friction, can also be studied by observing surface properties. These quantifiable data can be obtained to ensure the catheter can be used for medical applications.

Importance of Profilometry for Catheters

Compared to optical microscopy and electron microscopy, 3D Non-Contact Profilometry using axial chromatism is highly preferable for characterizing catheter surfaces due to its ability to measure angles/curvature, ability to measure material surfaces despite transparency or reflectivity, minimal sample preparation, and non-invasive nature. Unlike conventional optical microscopy, the height of the surface can be obtained and used for computational analysis; e.g. finding dimensions and removing form to find surface roughness. Having little sample preparation, in contrast to electron microscopy, and non-contact nature also allows for quick data collection without fearing contamination and error from sample preparation.

MEASUREMENT OBJECTIVE

In this application, the Nanovea 3D Non-Contact Profilometer is used to scan the surface of two catheters: one made of TPE (Thermoplastic Elastomer) and the other made of PVC (Polyvinyl Chloride). The morphology, radial dimension, and height parameters of the two catheters will be obtained and compared.

Sample of catheter being anaylzed with the Nanovea 3D Profilometer

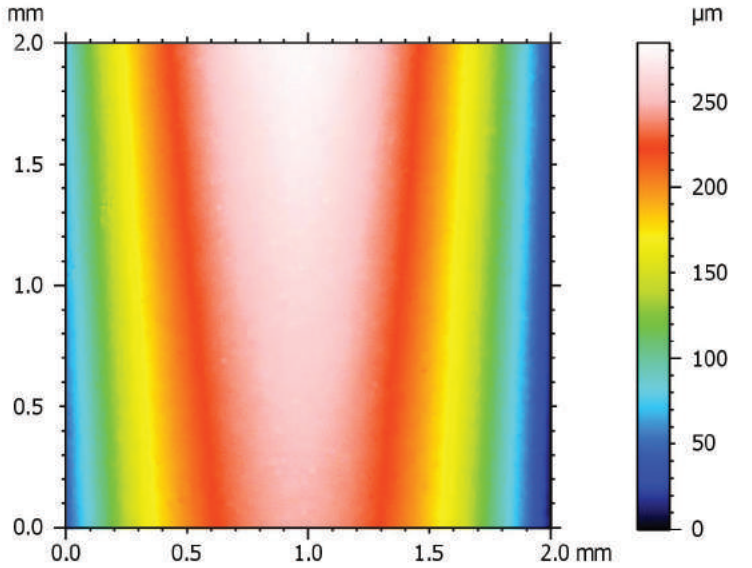
Sample of catheter

RESULTS AND DISCUSSION

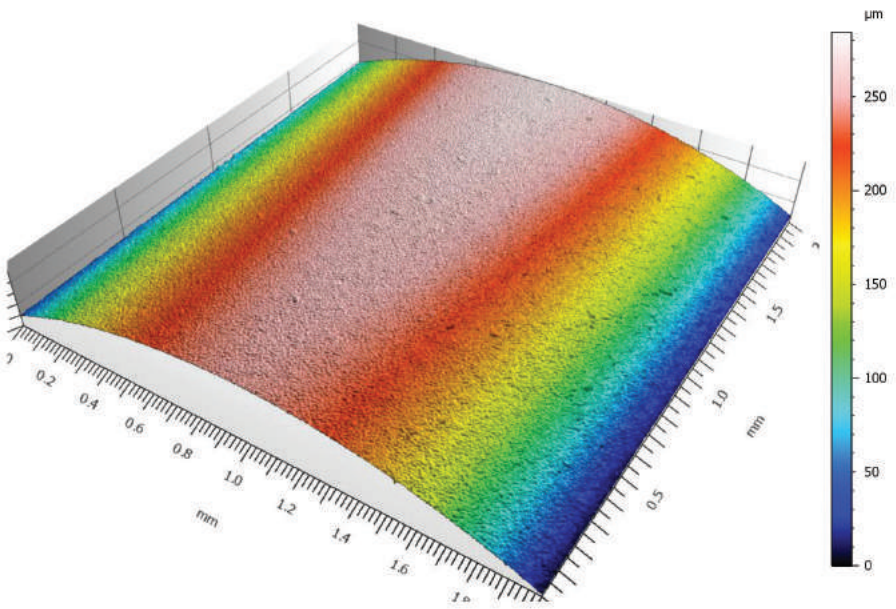
3D Surface

Despite the curvature on polymeric tubes, the Nanovea 3D Non-contact profilometer can scan the surface of the catheters. From the scan done, a 3D image can be obtained for quick, direct visual inspection of the surface.

TPE Catheter :

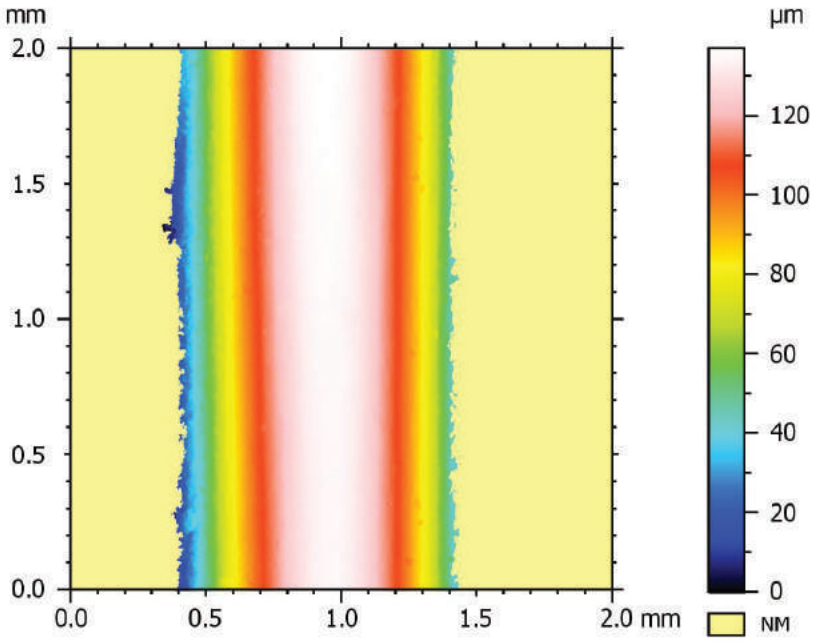


False color view

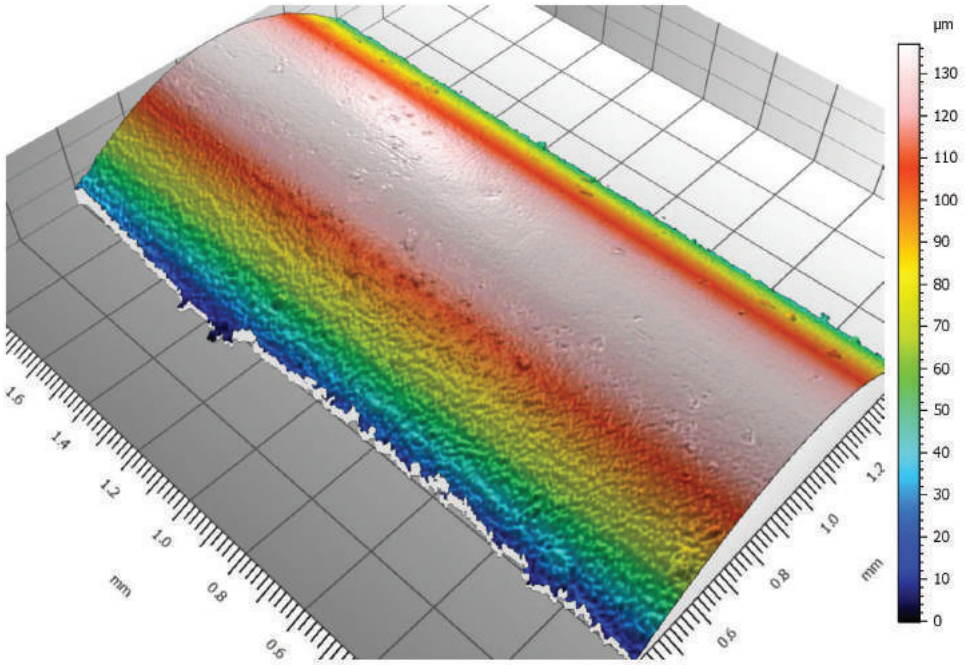


3D View

PVC Catheter :



False color view

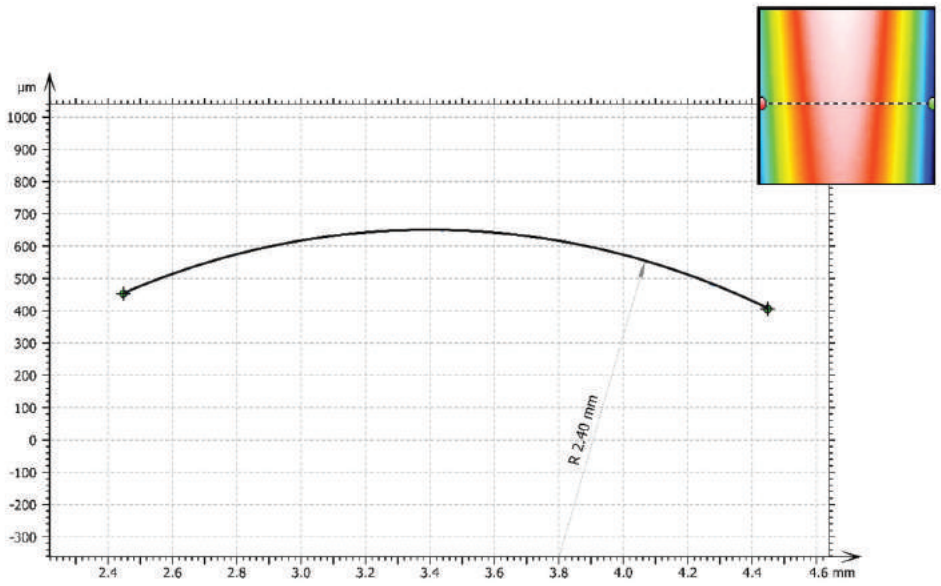


3D View

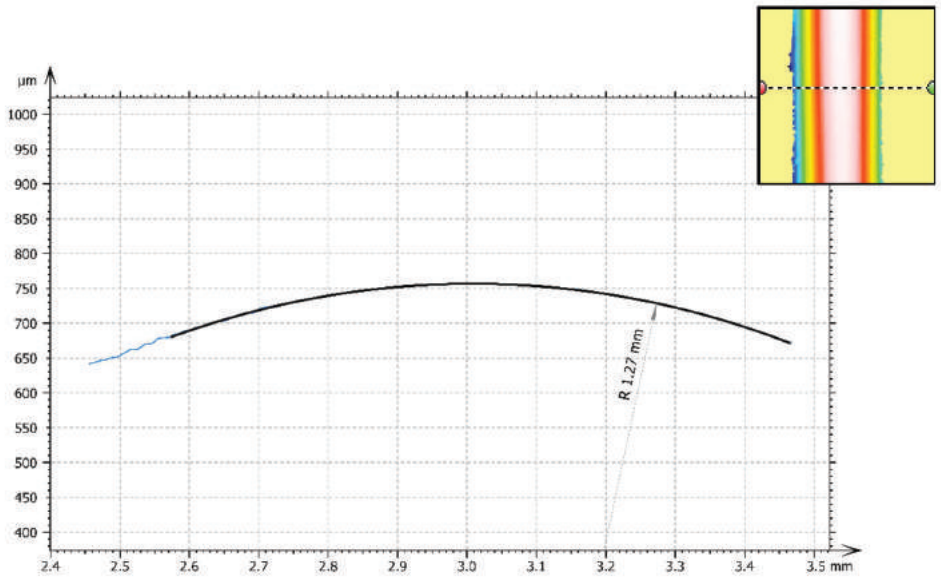
2D Dimensional Analysis

The outer radial dimension was obtained by extracting a profile from the original scan and fitting an arc to the profile. This shows the ability of the 3D Non-contact profilometer in conducting quick dimensional analysis for quality control applications. Multiple profiles can easily be obtained along the catheter's length as well.

TPE Catheter :



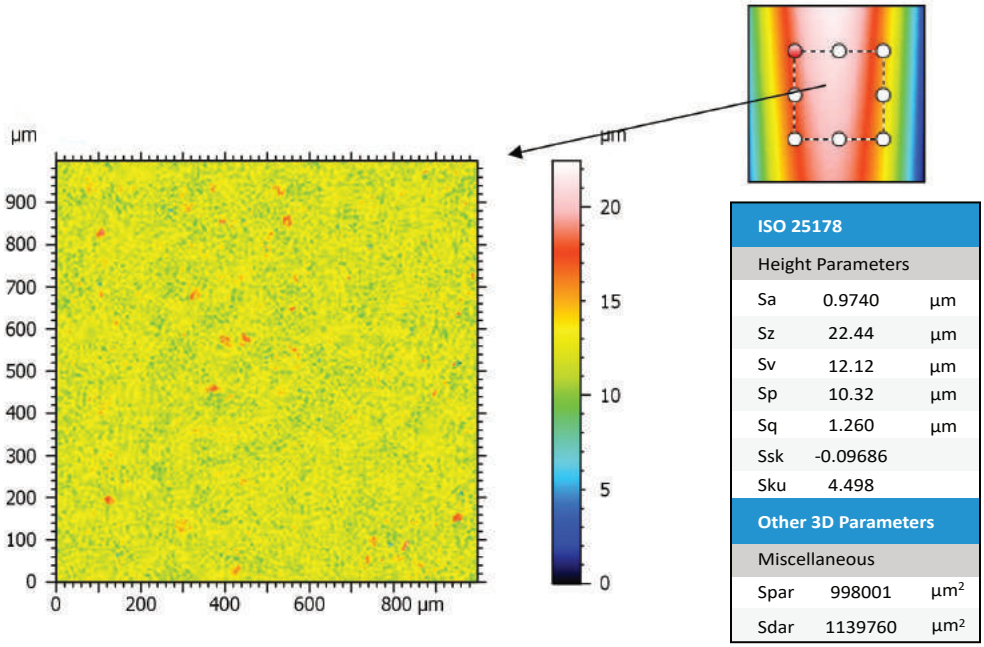
PVC Catheter :



Surface Roughness Analysis

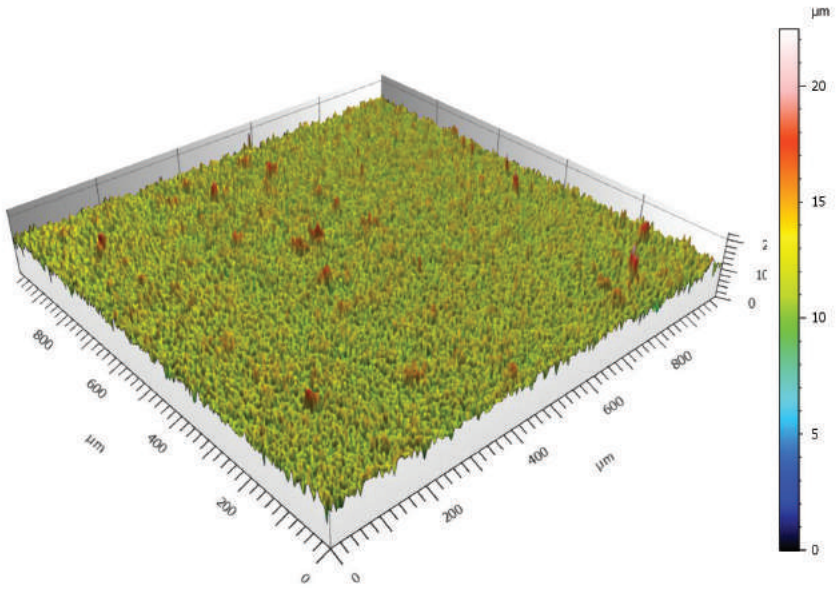
The outer radial dimension was obtained by extracting a profile from the original scan and fitting an arc to the profile. This shows the ability of the 3D Non-contact profilometer in conducting quick dimensional analysis for quality control applications. Multiple profiles can easily be obtained along the catheter's length as well.

TPE Catheter :



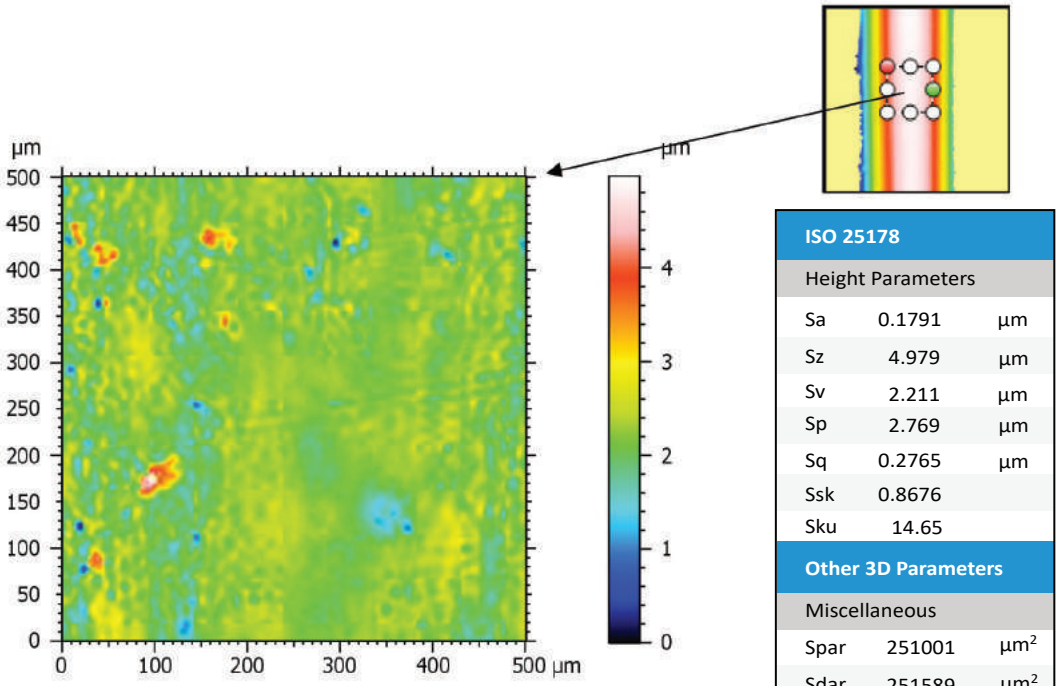
ISO 25178		
Height Parameters		
Sa	0.9740	µm
Sz	22.44	µm
Sv	12.12	µm
Sp	10.32	µm
Sq	1.260	µm
Ssk	-0.09686	
Sku	4.498	
Other 3D Parameters		
Miscellaneous		
Spar	998001	µm²
Sdar	1139760	µm²

False color view



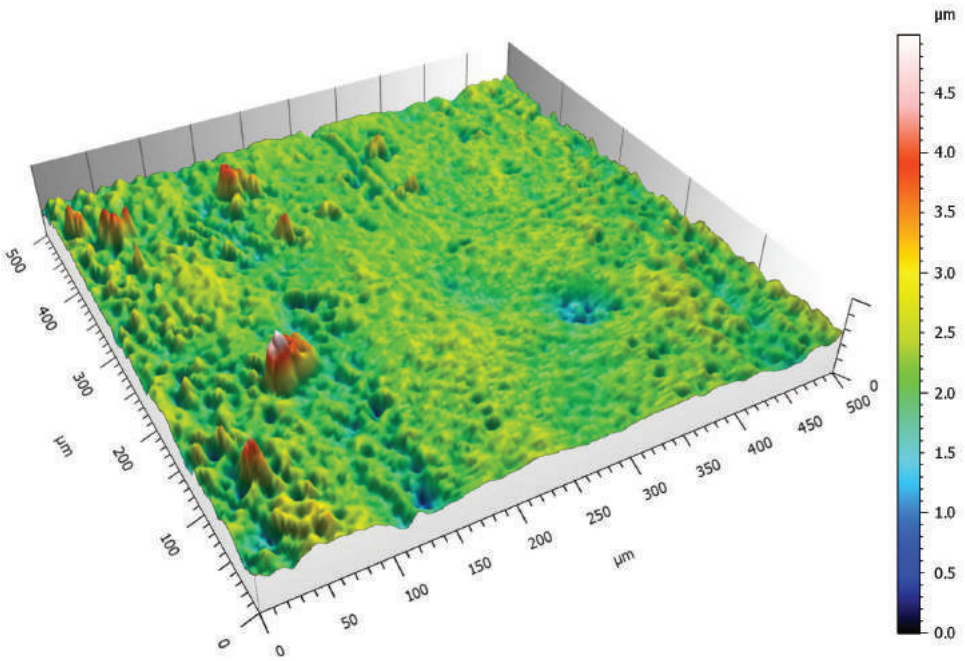
3D View

PVC Catheter :



ISO 25178		
Height Parameters		
Sa	0.1791	µm
Sz	4.979	µm
Sv	2.211	µm
Sp	2.769	µm
Sq	0.2765	µm
Ssk	0.8676	
Sku	14.65	
Other 3D Parameters		
Miscellaneous		
Spar	251001	µm²
Sdar	251589	µm²

False color view



3D View

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info@nanovea.com
euro@nanovea.com
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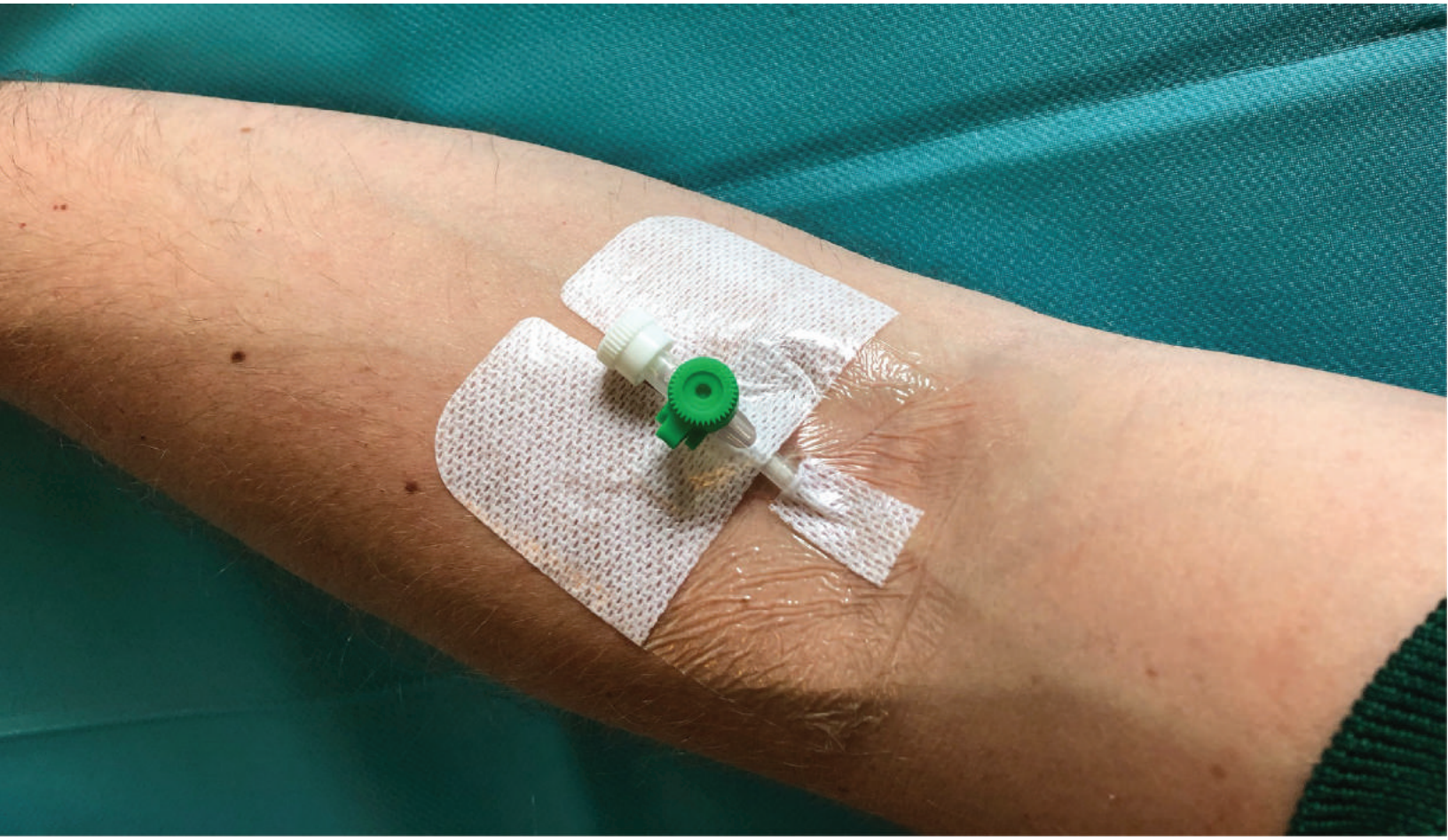

Conclusion

In this application, we have shown how the Nanovea 3D Non-contact profilometer can be used to characterize polymeric tubes. Specifically, surface metrology, radial dimensions, and surface roughness were obtained for medical catheters. The outer radius of the TPE catheter was found to be 2.40mm while the PVC catheter was 1.27mm. The surface of the TPE catheter was found to be rougher than the PVC catheter. The Sa of TPE was 0.9740µm compared to 0.1791µm of PVC. While medical catheters were used for this application, 3D Non-Contact Profilometry can be applied to a large variety of surfaces as well. Obtainable data and calculations are not limited to what is shown.

Learn more about the Nanovea Profilometer or Lab Services.

This Report has been created using one of

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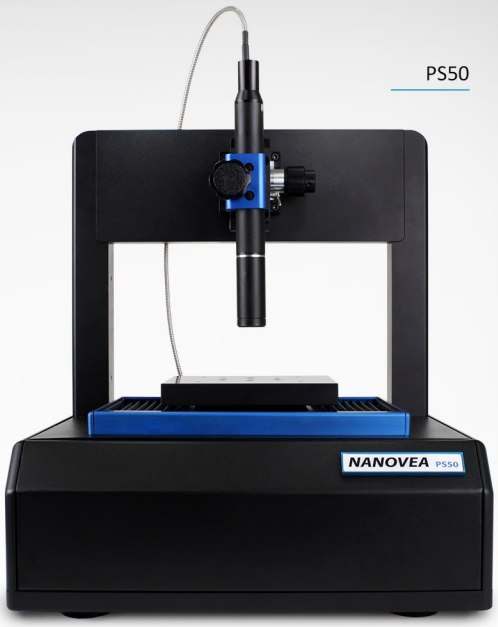

CHROMATIC LIGHT

Analyze Any Surface
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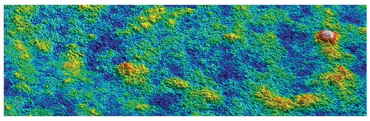
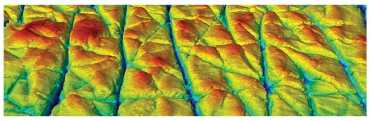
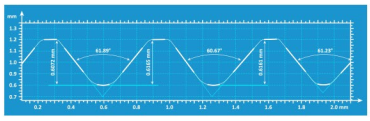
2D & 3D SURFACE MEASUREMENT



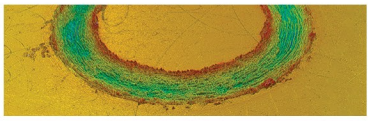
ROUGHNESS & FINISH



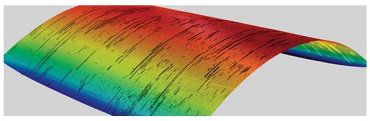
TEXTURE



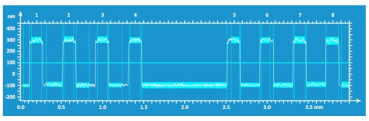
GEOMETRY & SHAPE



VOLUME & AREA



FLATNESS & WARPAGE



STEP HEIGHT & THICKNESS





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