

**NANOVEA**

# ***SANDPAPER***

***ROUGHNESS & PARTICLE DIAMETER ANALYSIS***



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# ***INTRODUCTION***

Sandpaper is a common commercially available product used as an abrasive. The most common use for sandpaper is to remove coatings or to polish a surface with its abrasive properties. These abrasive properties are classified into grits, each related to how smooth or rough of a surface finish it will give. To achieve desired abrasive properties, manufacturers of sandpaper must ensure that the abrasive particles are of a specific size and have little deviation. To quantify the quality of sandpaper, **NANOVEA's** 3D Non-Contact Profilometer can be used to obtain the arithmetic mean ( $S_a$ ) height parameter and average particle diameter of a sample area.

## ***IMPORTANCE OF 3D NON-CONTACT OPTICAL PROFILER FOR SANDPAPER***

When using sandpaper, interaction between abrasive particles and the surface being sanded must be uniform to obtain consistent surface finishes. To quantify this, the surface of the sandpaper can be observed with **NANOVEA's** 3D Non-Contact Optical Profiler to see deviations in the particle sizes, heights, and spacing.

# MEASUREMENT OBJECTIVE

*In this study, five different sandpaper grits (120, 180, 320, 800, and 2000) are scanned with the **NANOVEA ST400** 3D Non-Contact Optical Profiler.*

*The  $S_a$  is extracted from the scan and the particle size is calculated by conducting a Motifs analysis to find their equivalent diameter.*

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ABOUT THE INSTRUMENT](#)

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**NANOVEA**  
**ST400**



# RESULTS

The sandpaper decreases in surface roughness ( $S_a$ ) and particle size as the grit increases, as expected. The  $S_a$  ranged from  $42.37 \mu\text{m}$  to  $3.639 \mu\text{m}$ . The particle size ranges from  $127 \pm 48.7$  to  $21.27 \pm 8.35$ . Larger particles and high height variations create stronger abrasive action on surfaces as opposed to smaller particles with low height variation.

Please note all definitions of the given height parameters are listed on page.A.1.

<b>GRIT</b>	<b><math>S_a</math></b>	<b><math>S_z</math></b>	<b><math>S_v</math></b>	<b><math>S_p</math></b>	<b><math>S_q</math></b>	<b><math>S_{sk}</math></b>	<b><math>S_{ku}</math></b>
<b>120</b>	42.37	527.2	235.7	291.5	59.45	0.314	4.397
<b>180</b>	27.28	350.4	174.7	175.8	37.83	0.2653	4.734
<b>320</b>	17.92	325.5	138.1	187.3	24.6	0.2388	5.008
<b>800</b>	6.273	119.4	45.35	74.05	8.492	0.6921	5.516
<b>2000</b>	3.639	62.04	17.89	44.15	4.659	0.5882	4.454

**TABLE 1:** Comparison between sandpaper grits and height parameters.

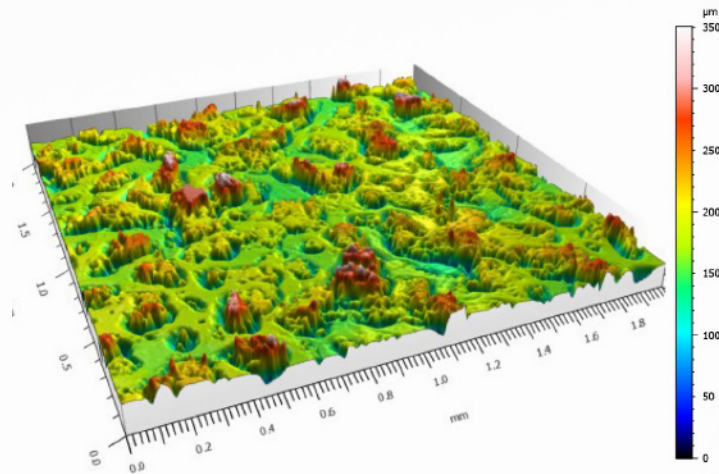
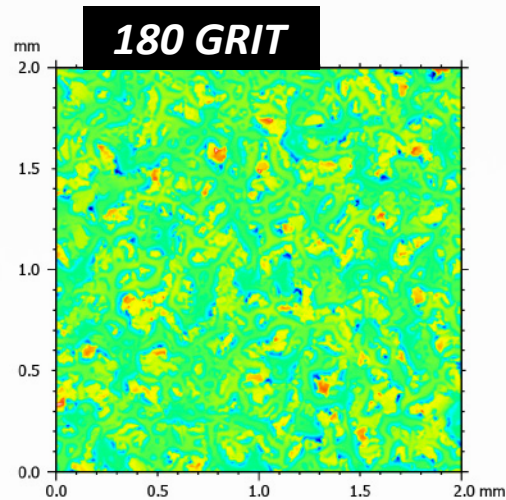
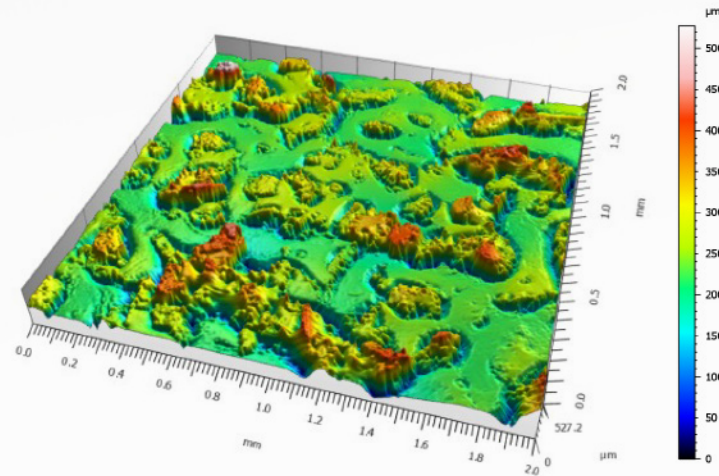
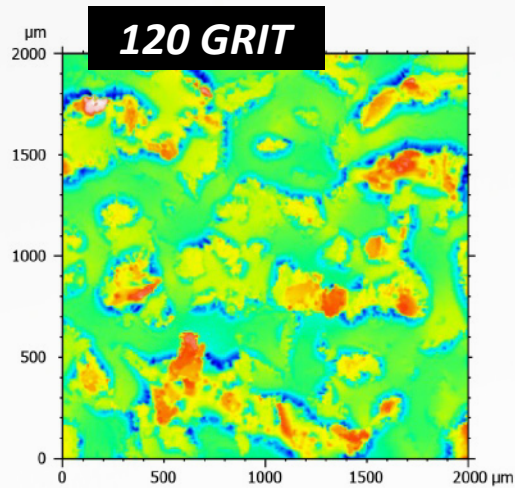
<b>GRIT</b>	<b>EQUIVALENT PARTICLE DIAMETER</b>
<b>120</b>	$127.0 \pm 48.7$
<b>180</b>	$105.6 \pm 35.43$
<b>320</b>	$67.18 \pm 22.62$
<b>800</b>	$28.16 \pm 8.58$
<b>2000</b>	$21.27 \pm 8.35$

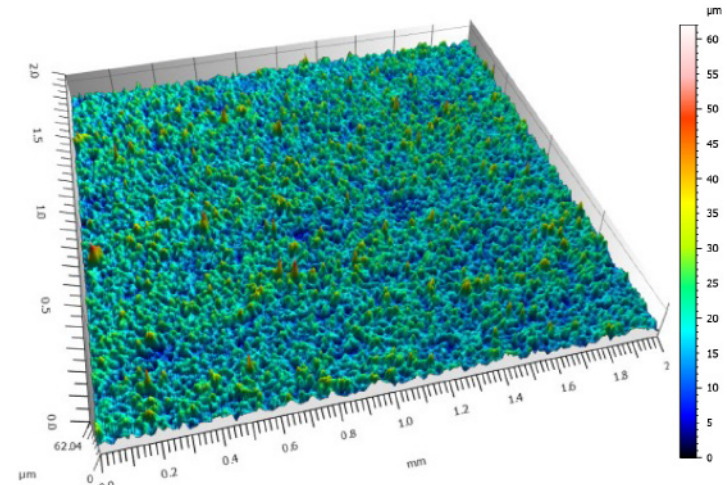
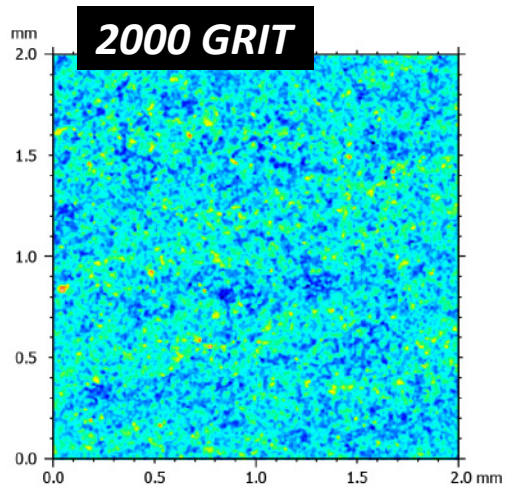
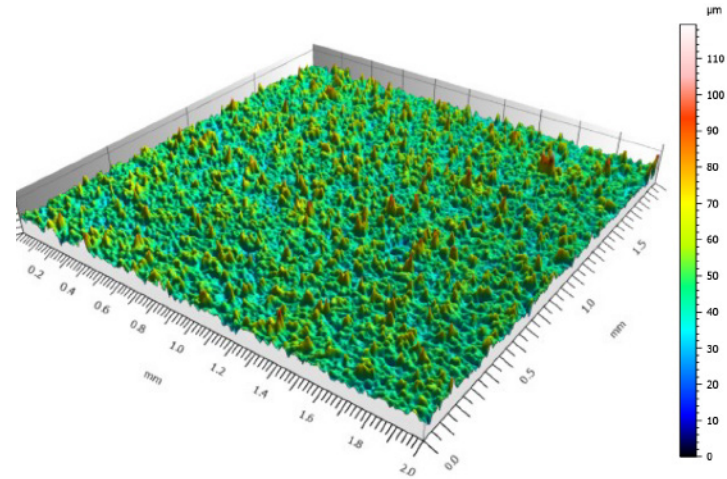
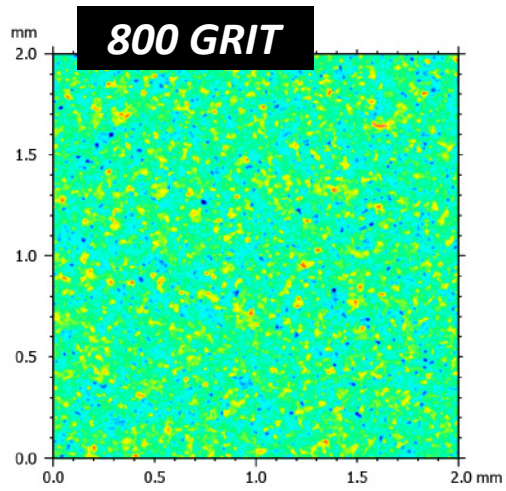
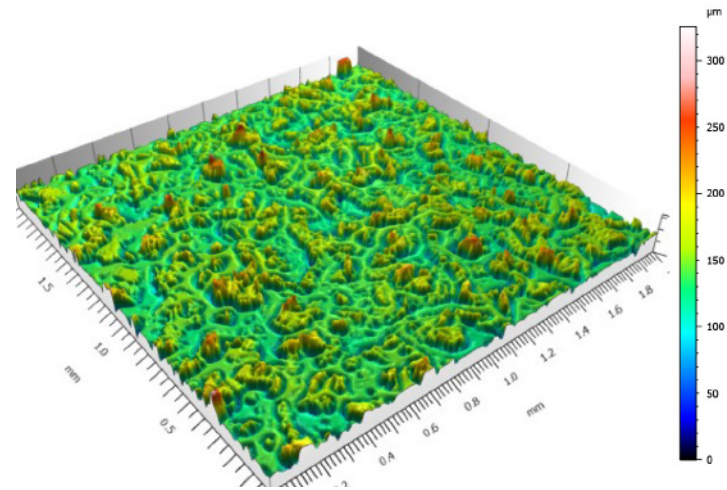
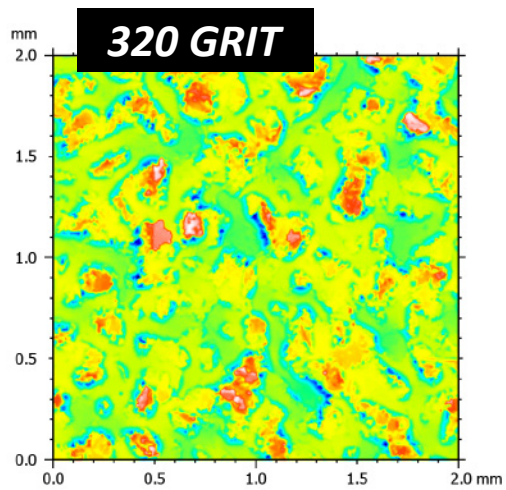
**TABLE 2:** Comparison between sandpaper grits and particle diameter.



# 2D/3D VIEW OF SANDPAPER

*Below are the false-color and 3D view for the sandpaper samples.  
A gaussian filter of 0.8 mm was used to remove the form or waviness.*

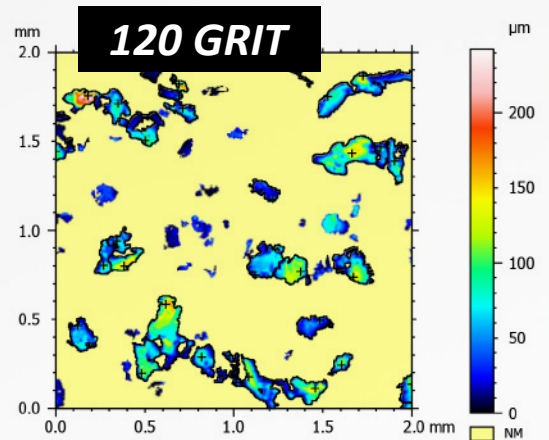




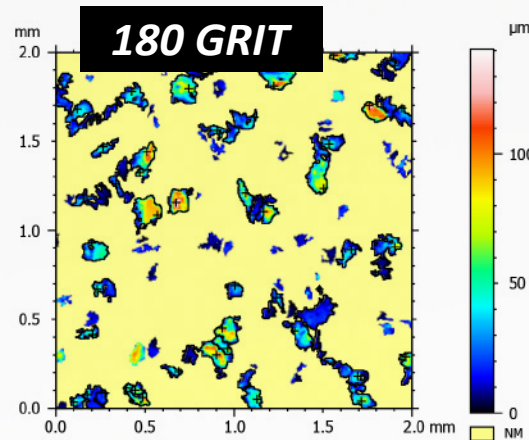


# MOTIF ANALYSIS

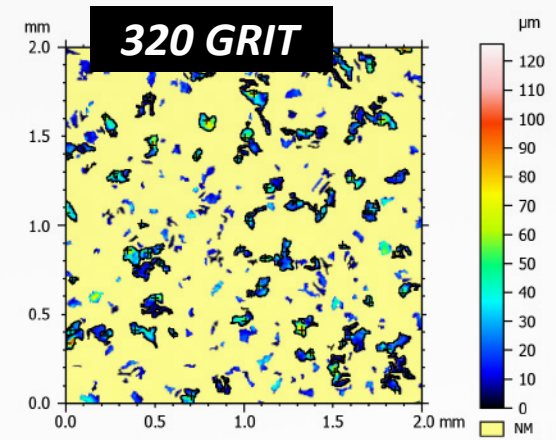
To accurately find the particles at the surface, the scanned surface was thresholded to only show the upper layer of the sandpaper. A motif analysis was conducted afterwards to detect peaks from the thresholded surface.



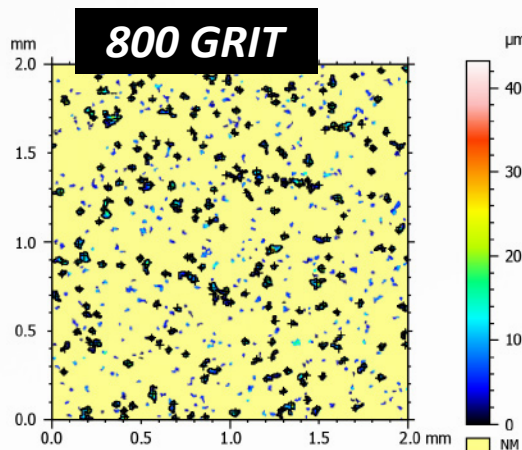
Number of motifs			
	35		
Parameters	Stat.	Value	Unit
Height	Mean	98.75	µm
	Std dev	36.02	µm
Equivalent diameter	Mean	0.1270	mm
	Std dev	0.04867	mm



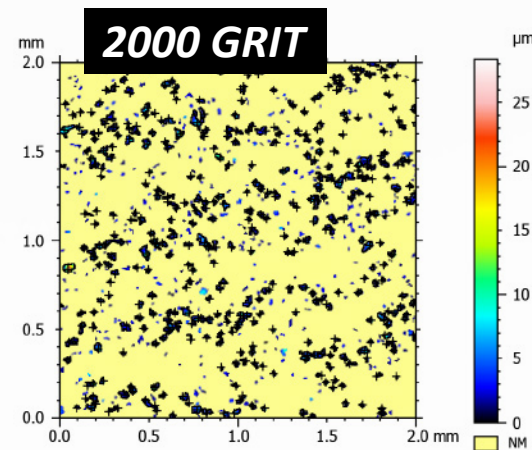
Number of motifs			
	47		
Parameters	Stat.	Value	Unit
Height	Mean	61.68	µm
	Std dev	24.51	µm
Equivalent diameter	Mean	0.1056	mm
	Std dev	0.03543	mm



Number of motifs			
	67		
Parameters	Stat.	Value	Unit
Height	Mean	47.12	µm
	Std dev	18.82	µm
Equivalent diameter	Mean	0.06718	mm
	Std dev	0.02262	mm



Number of motifs			
	199		
Parameters	Stat.	Value	Unit
Height	Mean	12.77	µm
	Std dev	5.859	µm
Equivalent diameter	Mean	0.02816	mm
	Std dev	0.008583	mm



Number of motifs			
	384		
Parameters	Stat.	Value	Unit
Height	Mean	4.020	µm
	Std dev	3.136	µm
Equivalent diameter	Mean	0.02127	mm
	Std dev	0.008345	mm



## CONCLUSION

**NANOVEA's** 3D Non-Contact Optical Profiler was used to inspect the surface properties of various sandpaper grits due to its ability to scan surfaces with micro and nano features with precision.

Surface height parameters and the equivalent particle diameters were obtained from each of the sandpaper samples using advanced software to analyze the 3D scans. It was observed that as the grit size increased, the surface roughness ( $S_a$ ) and particle size decreased as expected.