




Mahr



Mahr | MarSurf 3D CM Mobile

---

# CM Mobile

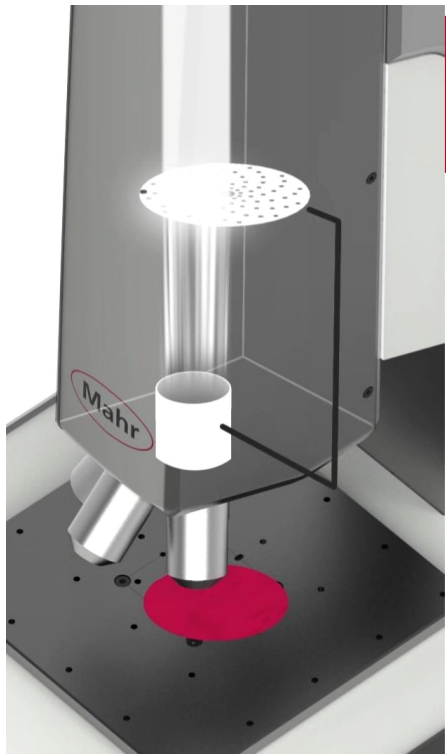
## 製品紹介

# ポータブル型共焦点顕微鏡: MarSurf CM Mobile

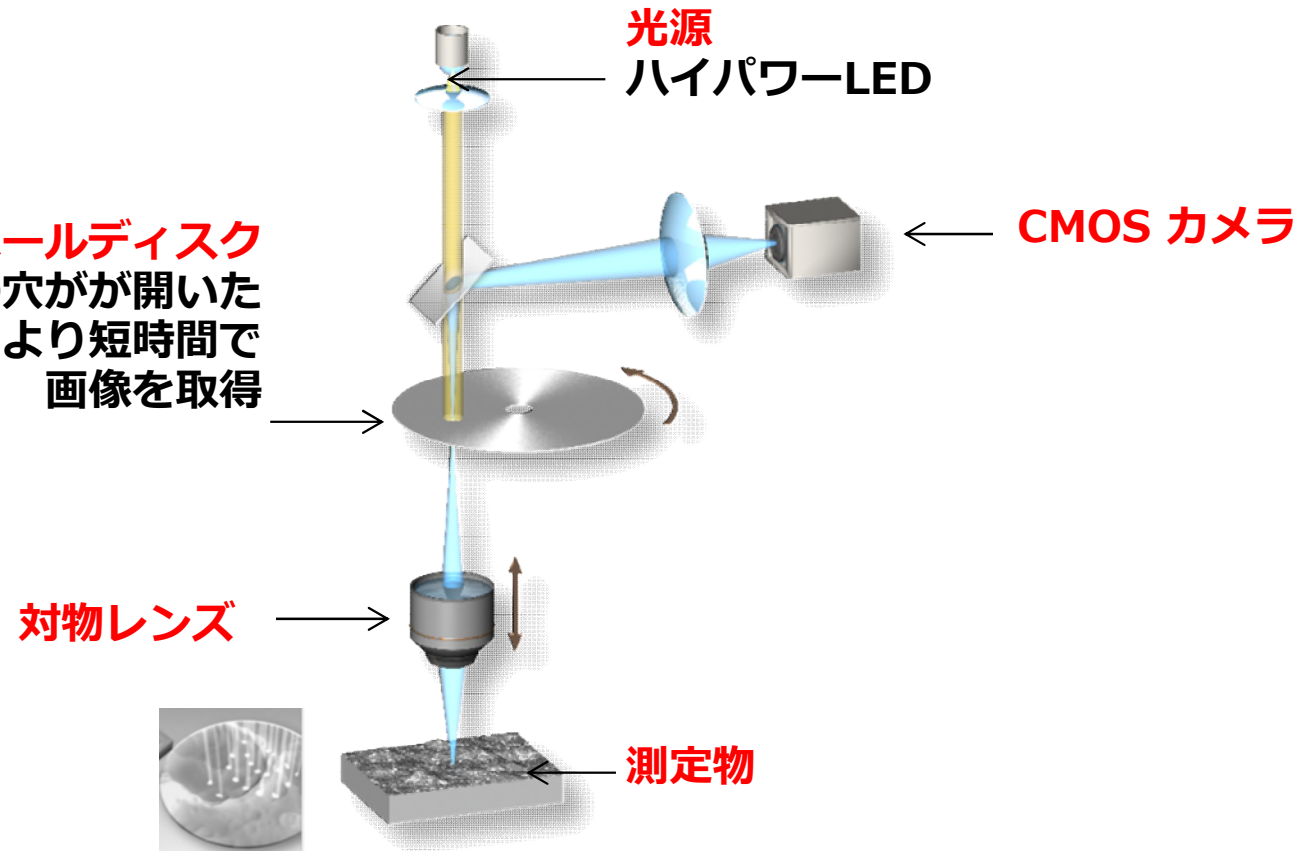


	MarSurf CM Mobile
測定原理	共焦点/ <b>マルチピンホールディスクを採用</b>
x/y/z 作動域	50mm x 50mm x 35mm
垂直方向測定域	350 um
最大水平方向分解能	0.16 um
最大垂直方向分解能	<b>2 nm</b>
測定スピード	<b>最短7秒</b>
粗さ 分解能	Ra > 0.01 um
特徴	<ul style="list-style-type: none"><li>• 本体の持ち運びが可能</li><li>• 測定時間の速さ</li><li>• 振動に強く、安定した測定データ</li></ul>

# 測定原理- 共焦点



**マルチピンホールディスク**  
不規則に複数の穴が開いた  
ディスクの回転により短時間で  
画像を取得



# トレーサビリティ

測定機は、VDI / VDEガイドライン2655に従って承認されており、測定精度は、国際認証規格PTBに従って校正されています。

## 使用される基準片

- 平坦度シリコン 平面度規格 (ISO12179)
- 深さ標準片 タイプA2 (ISO 5436-1、57044 PTB 12)
- 間隔用標準片 タイプC3 (ISO 5436-1、4097 PTB 01)
- 粗さ標準片 タイプD1 (ISO 5436-1、57209 PTB 11)

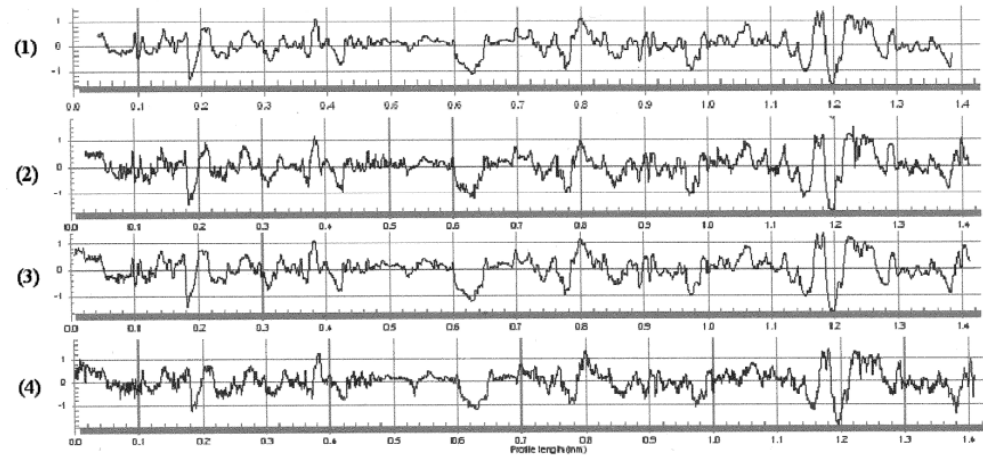


# 接触式粗さ測定機とMarSurf CM Mobileの測定結果の相関性

## 相関性 99%

アメリカ国立標準技術研究所企画SRM2460による非接触測定法の比較研究において、MarSurf CMシリーズと接触粗さ測定機が最も高い相関性を示しました。

Comparative study:  
Correlations of topography measurements of NIST SRM 2460 standard bullets by four techniques, Meas. Sci. Technol., London 2006



接触式粗さ測定機

白色干渉顕微鏡

MarSurf CM

他社製共焦点レーザー顕微鏡

Figure 2. The profile of a standard bullet is measured by four techniques. 1) Stylus instrument,  $CCF_{max} = 99.6\%$ ; 2) Interferometric microscope,  $CCF_{max} = 92.1\%$ ; 3) Nipkow disk confocal microscope,  $CCF_{max} = 99.0\%$ ; 4) Laser scanning confocal microscope,  $CCF_{max} = 95.3\%$ . The vertical unit is  $\mu\text{m}$ , the horizontal unit is mm.

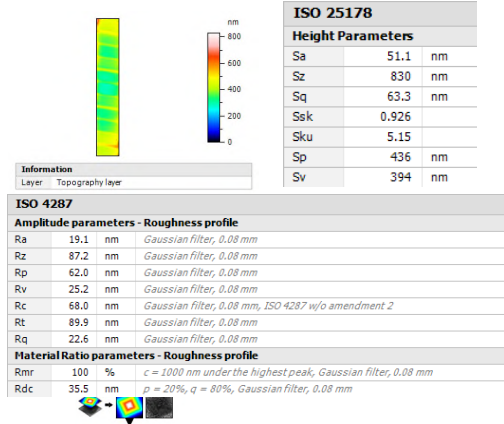
CCF(ACF): Auto-Correlation-Function

# 使用例

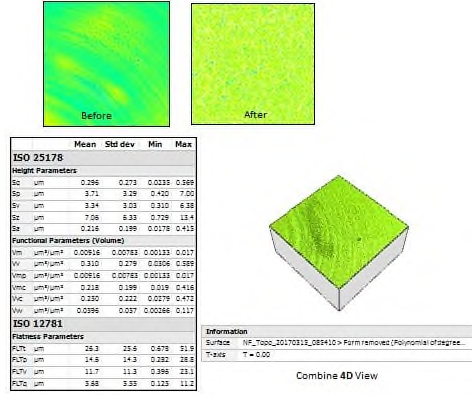


# 測定評価

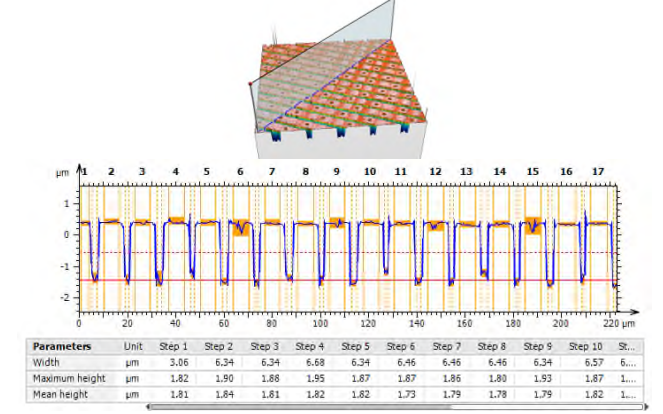
## 粗さ (Ra, Rz, Sa, Sz)



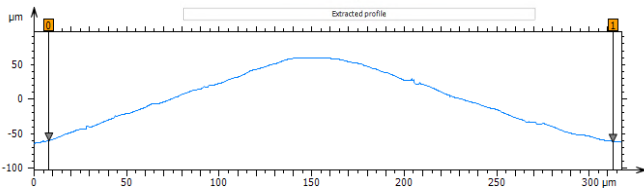
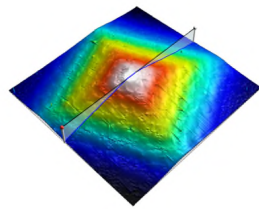
## キズ



## コプラナリティ

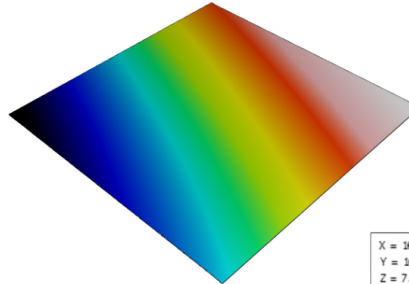


## 断面



Parameters	0-1	Unit
Horizontal distance	305	μm
Height difference	-1.91	μm

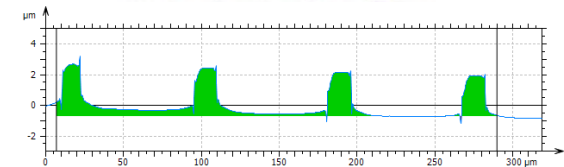
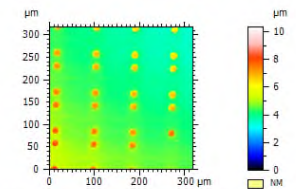
## 平坦度



**ISO 12781**  
**Flatness Parameters**

FLT	6.17	μm	Peak-to-valley flatness deviation of the surf...
FLP	3.19	μm	Peak-to-reference flatness deviation
FLV	2.98	μm	Reference-to-valley flatness deviation
FLTq	1.37	μm	Root-mean-square flatness deviation

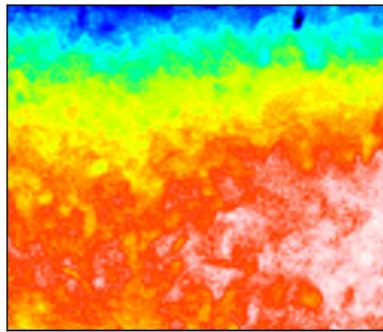
## 体積



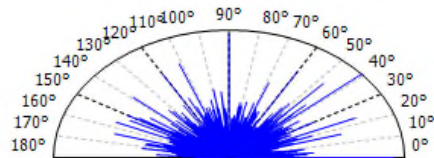
Parameters	Value	Unit
Maximum depth	0.549	μm
Area of the hole	3.85	μm²
Maximum height	3.88	μm
Area of the peak	210	μm²

# 測定評価 - 表面粗さ 3D

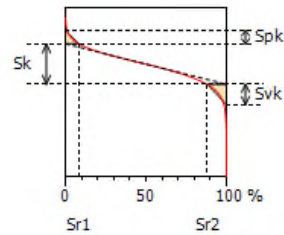
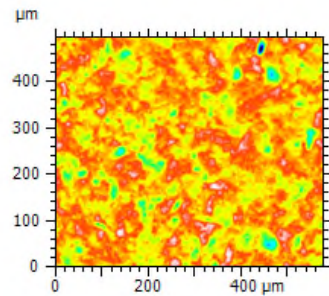
## Surface Roughness ISO 25178



Form removed (Polynomial of degree 2)  
 $-32.419 - 0.011174*x + 7.4071e-05*x^2 - 0.34682*y - 5.6...$

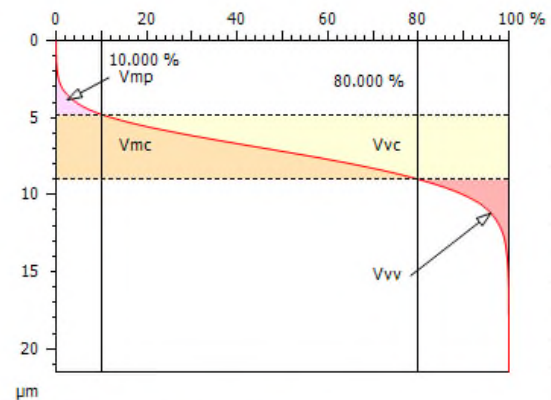


Parameters	Value	Unit
Isotropy	82.198	%
First Direction	40.771	°



Information		
Filter settings	Unfiltered.	
Parameters	Value	Unit
Sk	5.1605	µm
Sa1	0.071167	µm³/µm²
Sa2	0.15479	µm³/µm²

ISO 25178		
Height Parameters		
Sa	1.6475	µm Arithmetic mean height
Sp	7.3204	µm Maximum peak height
Sv	14.189	µm Maximum pit height
Sz	21.510	µm Maximum height
Feature Parameters		
SI0z	15.496	µm Ten point height

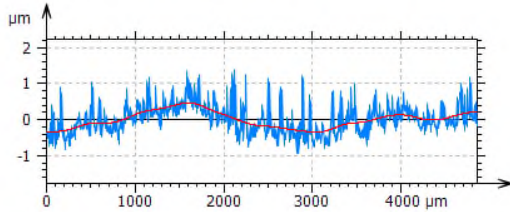


Parameters	Value	Unit
Vmp	0.086228	ml/m2
Vmc	1.8612	ml/m2
Vvc	2.3478	ml/m2
Vvv	0.27781	ml/m2

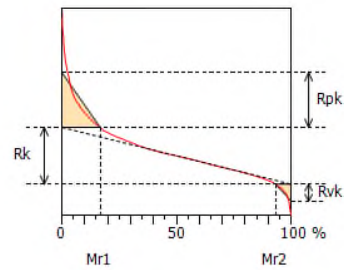


# 測定評価 - ライン粗さ

## Line roughness ISO 4287

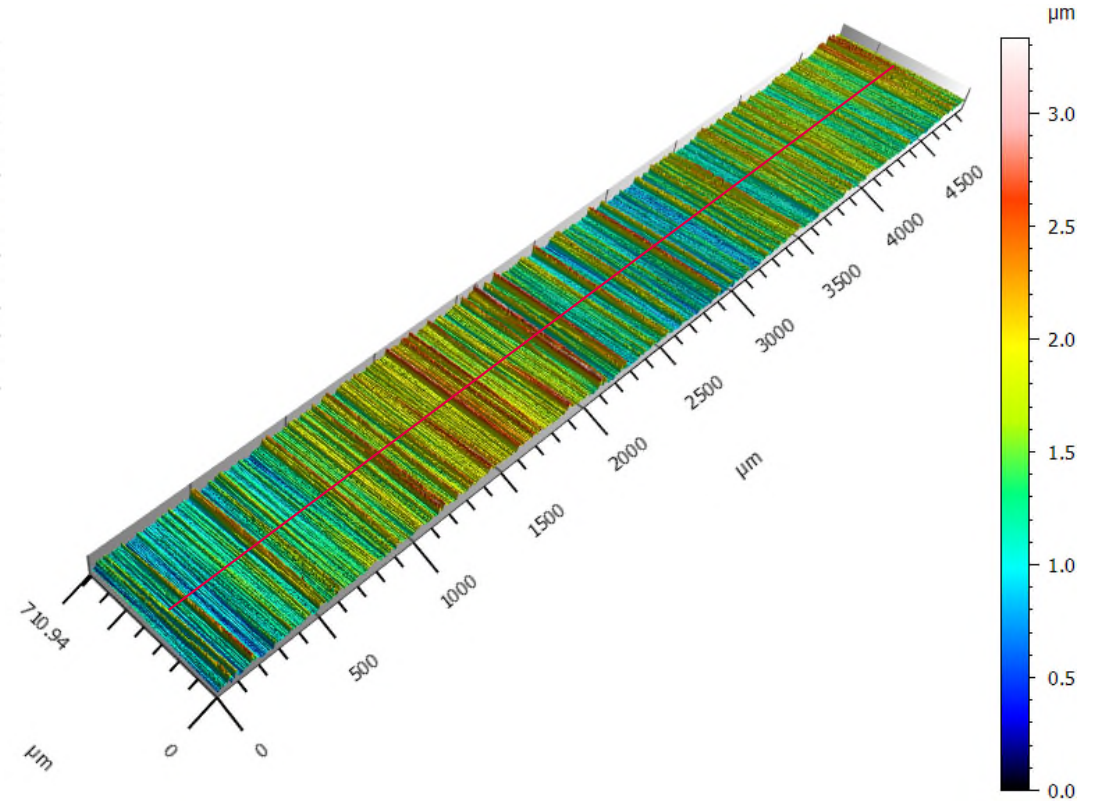


Information	
Profile	Waviness profile
Filter settings	Gaussian filter, cut-off 800.00 $\mu\text{m}$ , End effects managed



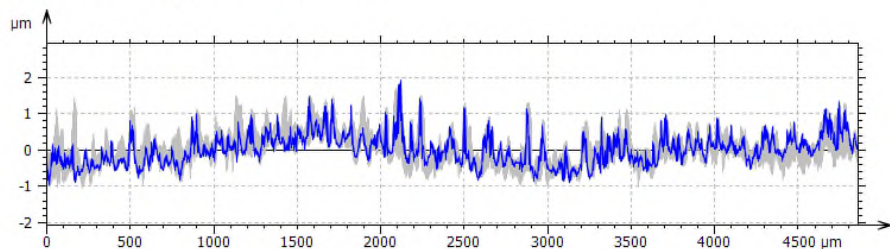
Information		
Filter settings	Gaussian filter, 800.00 $\mu\text{m}$ , End eff...	
Parameters	Value	Unit
Rk	0.60868	$\mu\text{m}$
Rpk	0.58861	$\mu\text{m}$
Rvk	0.18039	$\mu\text{m}$
Rpk*	1.2763	$\mu\text{m}$
Rvk*	0.33329	$\mu\text{m}$

ISO 4287			
Amplitude parameters - Roughness profile			
Ra	0.23221	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed
Rz	1.8008	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed
Rp	1.1889	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed
Rv	0.61183	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed
Rt	2.2182	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed
Rq	0.31173	$\mu\text{m}$	Gaussian filter, 0.8 mm, End effects managed



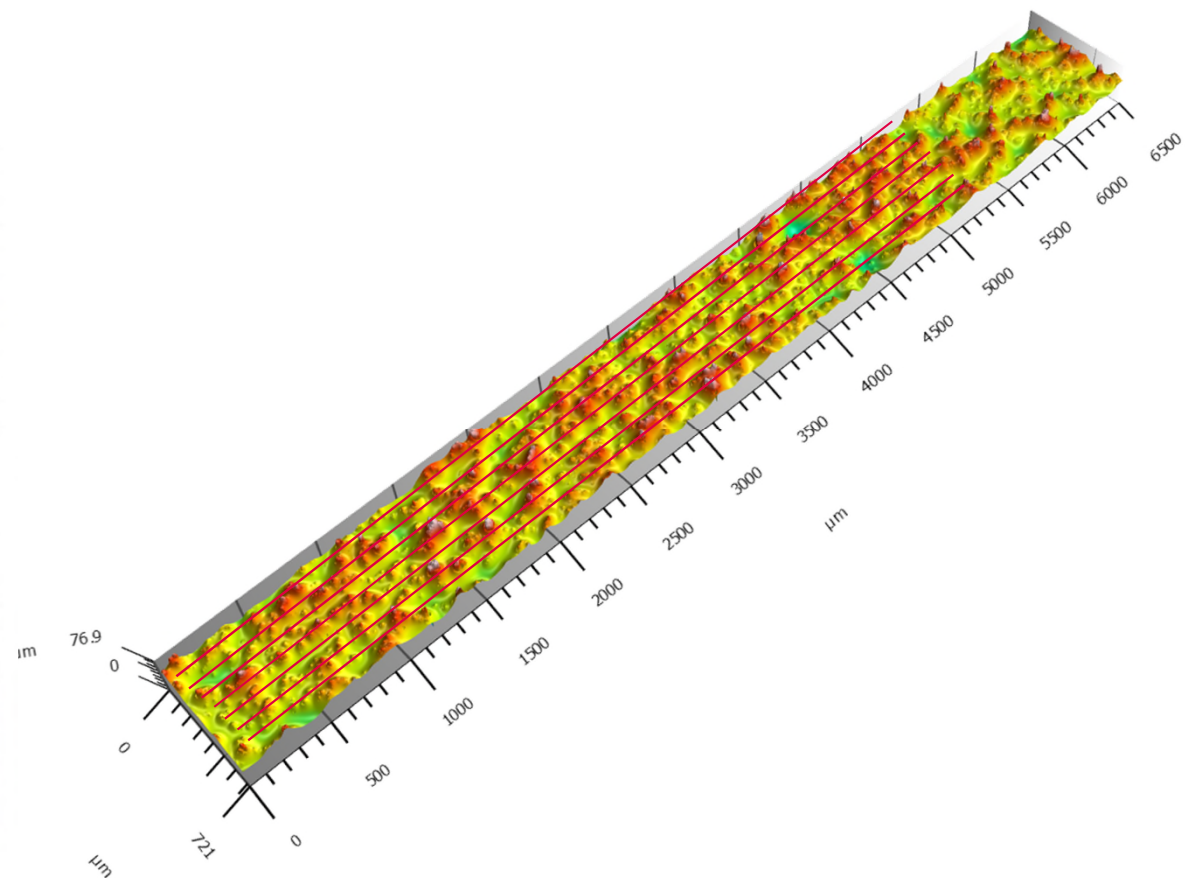
# 測定評価 - 複数の断面粗さ

Multi-Line Roughness ISO 4287

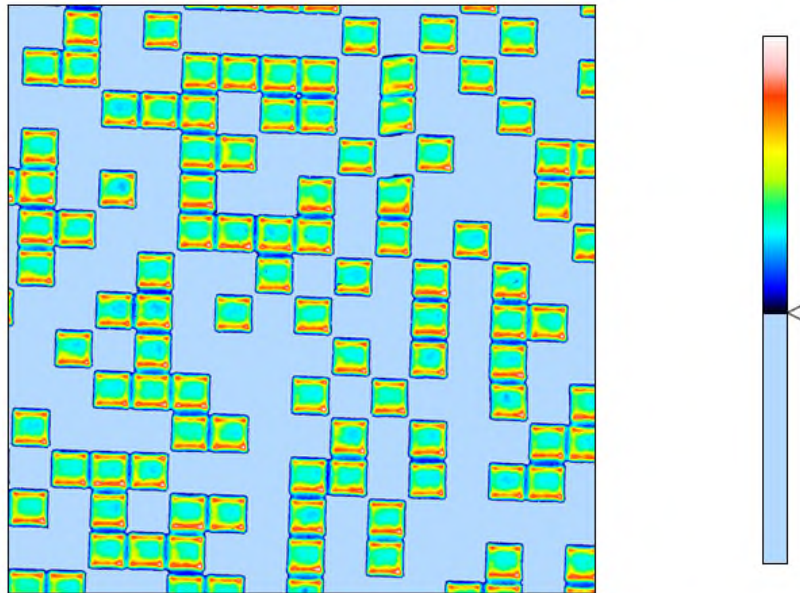


Information		
Profile	Hydro Rauheit > Leveled (Least squares method) > Topography layer (1 / 46)	
Parameters	Value	Unit
Length	4859.4	µm

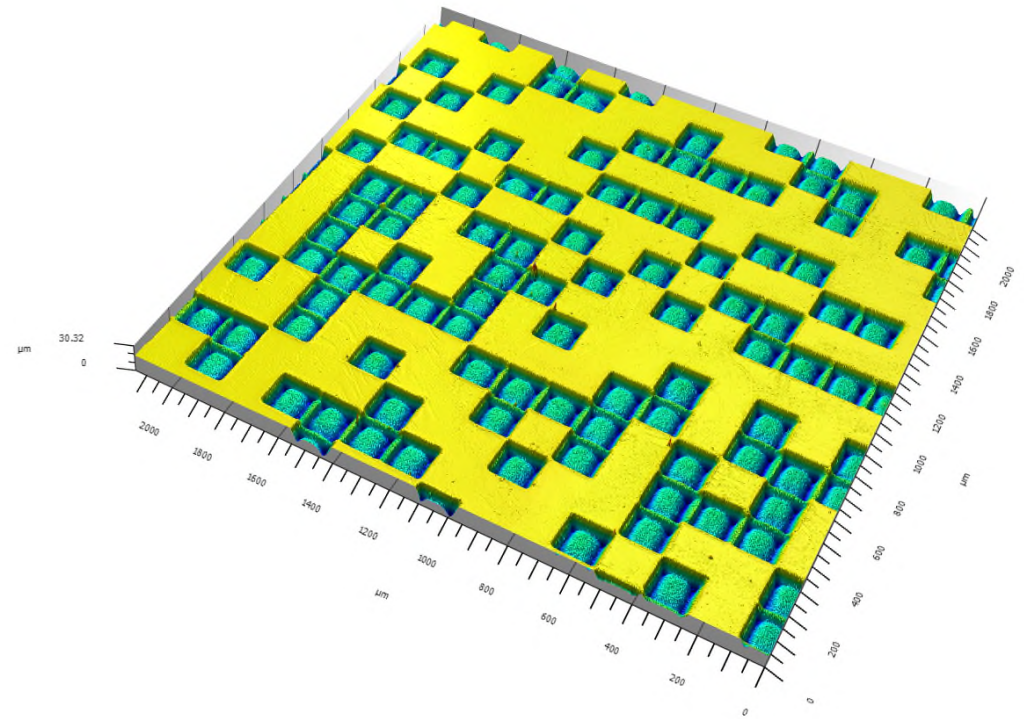
		Context	Mean	Std dev	Min	Max
<b>ISO 4287</b>						
<b>Amplitude parameters - Roughness profile</b>						
Ra	µm	Gaussian filter, 0.8 mm, End effects managed	0.23156	0.0086245	0.21755	0.24369
Rz	µm	Gaussian filter, 0.8 mm, End effects managed	1.8093	0.038585	1.7148	1.8910
Rp	µm	Gaussian filter, 0.8 mm, End effects managed	1.1999	0.033306	1.1186	1.2721
Rv	µm	Gaussian filter, 0.8 mm, End effects managed	0.60941	0.022726	0.55250	0.67792
Rt	µm	Gaussian filter, 0.8 mm, End effects managed	2.2476	0.079546	2.1117	2.4793
Rq	µm	Gaussian filter, 0.8 mm, End effects managed	0.30941	0.0097059	0.29351	0.32151



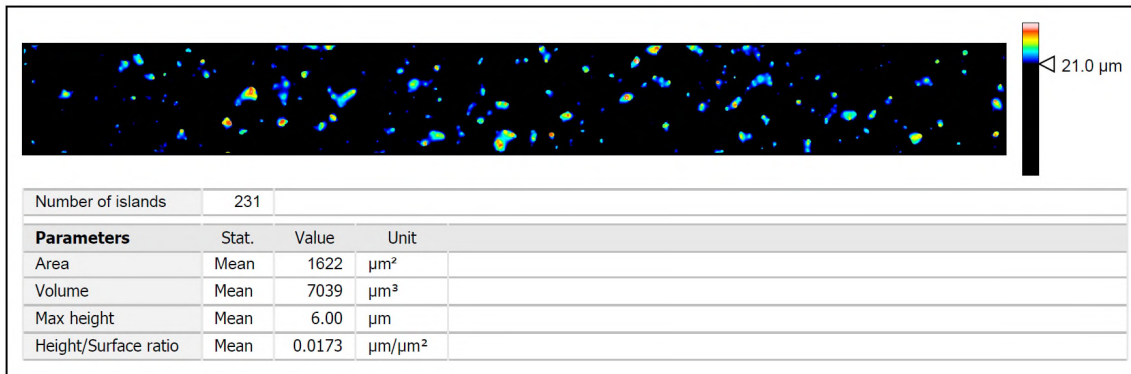
# 測定評価 - 体積



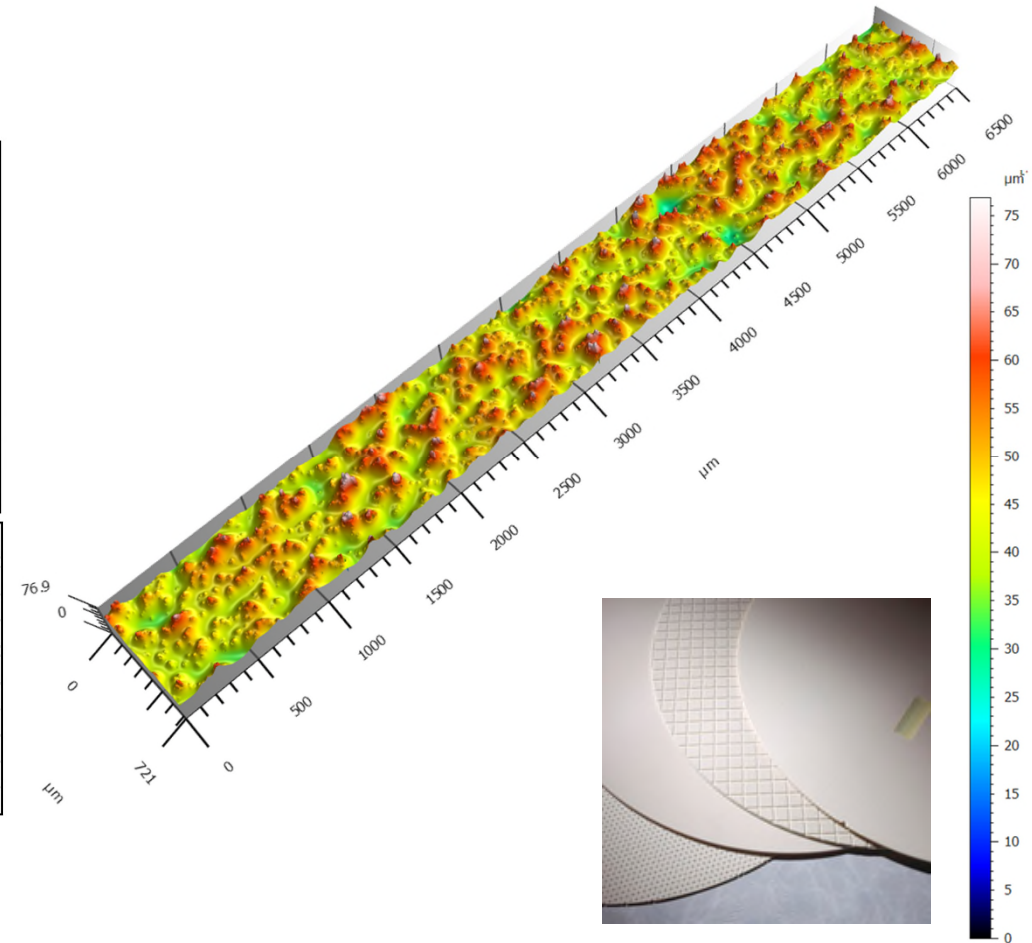
Number of islands	61		
Threshold	14.310	$\mu\text{m}$	
<b>Parameters</b>	<b>Stat.</b>	<b>Value</b>	<b>Unit</b>
Area	Mean	31889	$\mu\text{m}^2$
Volume	Mean	212404	$\mu\text{m}^3$
Max height	Mean	10.403	$\mu\text{m}$
Height/Surface ratio	Mean	0.0088829	$\mu\text{m}/\mu\text{m}^2$



# 測定評価 - 粒子測定 (半導体 CMPパッド)



Statistics over all grains - Binarized image after thresholding (21 μm)	
<b>Global information</b>	Value
Number of grains	231
Total area occupied by the grains	374793 μm <sup>2</sup> (8.00%)
<b>Grain parameters</b>	Unit Mean Std dev
Area	μm <sup>2</sup> 1622 2816
Perimeter	μm 131 138
Min diameter	μm 22.7 21.2
Max diameter	μm 45.2 46.5
Roundness	0.575 0.191



# 測定評価 - キズ評価

