Newsletter

SURFACE

Surface imaging, analysis & metrology news from Digital Surf

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WHAT'S COMING IN MOUNTAINS® 9?

'Shell' family		
Points	250000	
Facets	500000	
Height parameters		
Sq	9.937	mm
Ssk	0.06738	
Sku	2.475	
Sp	20.53	mm
Sv	19.40	mm
Sz	39.93	mm
Sa	8.344	mm

The Mountains® 9 version release is coming early June 2021 and it's packed with new features

Mountains® 9 comes with a new product branch for correlation and spectroscopy, new optional modules, a fresh look and many exciting features. Learn more about this major release and get an exclusive first look at what's coming in version 9 in our May 6 webinar.

Watch our WEBINARS

Digital learning resources

With many still working from home, digital resources are more useful than ever.

Our Mountains® webinars are online, available for you to watch, as many times as you need and from wherever your workspace is at the moment. bit.ly/3oWTBF9

THE MOUNTAINS® 9 RELEASE
WHAT'S COMING?

With version 9, to be released in June 2021, comes a whole new branch of Mountains® software, MountainsSpectral®, as well as several new optional modules and many exciting new features.

Users of 2D and 3D profilometry, scanning electron microscopy and scanning probe microscopy will discover a wealth of new capabilities for their image and surface data analysis.

Be sure to join us on May 6 at 4 PM CEST for an exclusive first look at what's new.
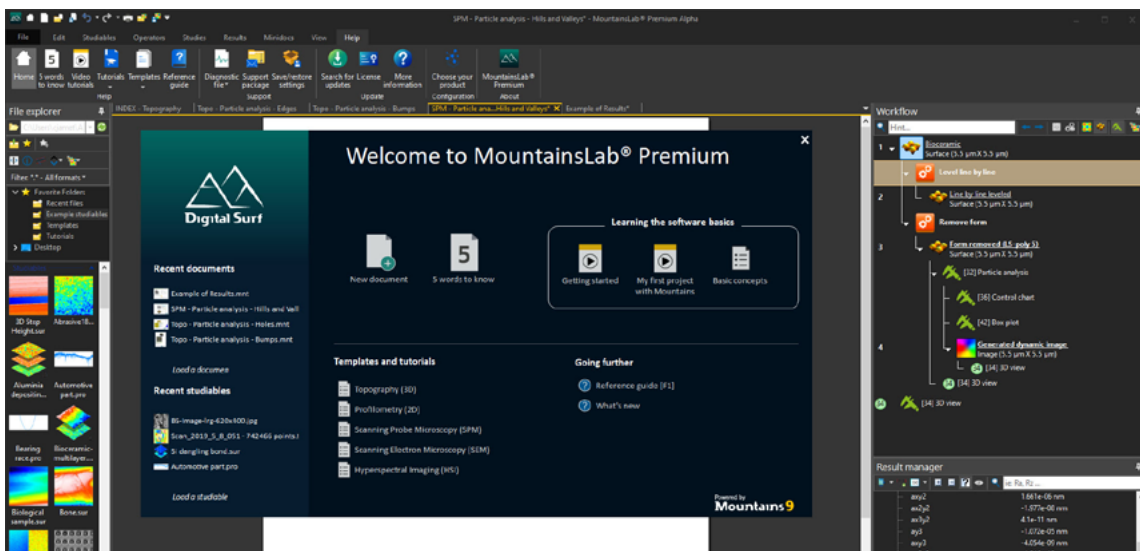
Above. The new Mountains® 9 platform will be available early June 2021.

EXTENDED RANGE

Since **MountainsMap®** was first introduced in 1997, the analysis software has become the industry standard for surface analysis. In 2013, **MountainsSEM®** took Scanning Electron Microscope image analysis to a new level with features for colorization and 3D reconstruction. **MountainsSPIP®** launched in 2018 following the merge of Digital Surf's Mountains® platform and Image Metrology's SPIP™, was fast adopted by professionals working with Atomic Force Microscopes and other Scanning Probe Microscopes.

Now, with version 9 comes **MountainsSpectral®** completing the product range and providing tools for Correlative Analysis and Spectral Analysis.

The multi-instrument solution **MountainsLab®** now comes of age, allowing data from practically any surface measuring instrument (profiler or mi-

croscope) to be analyzed with the same software, ensuring meaningful results and added value for users.

Several new modules make their debut in the version 9 release:
- ▶ **Shell Topography:** bringing surface texture analysis to freeform surfaces (shells)
- ▶ **Chemical cubes:** for the visualization & analysis of multichannel cubes of compositional data
- ▶ **IV Spectroscopy:** for datacube analysis including 3D visualization of datacube and individual I(v) curve analysis

MORE DATA TYPES SUPPORTED

Among new data types that can be loaded using Mountains® 9:
- ▶ point cloud data, allowing users to visualize and analyze data from 3D scanners etc.
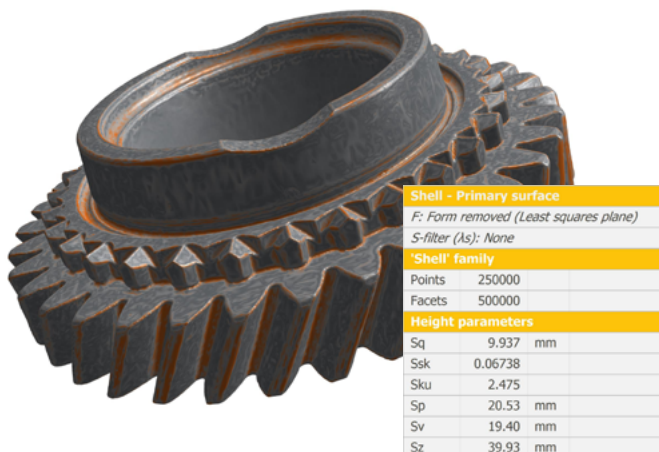
▶ multi-channel cubes: for studying the composition of materials in full 3D

NEW FEATURES FOR ALL USERS

Usability and productivity are at the heart of the Mountains® software platform. That's why version 9 aims to make life even easier for users.

As well as a new-look interface and modernized Analysis Workflow (see image left), improvements to all product levels include

▶ an **Image comparison slider** enabling quick comparison of different layers/images in the same dataset

▶ a **Result calculator** for calculating results directly in the Mountains® interface

▶ cross-product availability of **Statistics** tools for handling large quantities of measurement data.

Shell - Primary surface		
F: Form removed (Least squares plane)		
S-filter (λs): None		
'Shell' family		
Points	250000	
Facets	500000	
Height parameters		
Sq	9.937	mm
Ssk	0.06738	
Sku	2.475	
Sp	20.53	mm
Sv	19.40	mm
Sz	39.93	mm

Above. Calculate surface parameters on shells (freeform surfaces)

MOUNTAINSMAP®: STILL AT THE CUTTING EDGE OF NEW INDUSTRY PRACTICES

Thanks to Digital Surf's strong links with research on surface metrology and standardization bodies, Mountains® 9 continues to deliver innovative new tools for profilometry users.

In the new release, users can perform surface texture analysis on shell studiables (freeform surfaces) including the comparison to reference forms and the calculation of parameters.

Other improvements include volume parameters on 2D profiles and a vastly improved Abbott curve study.

MOUNTAINS® 9: THE ULTIMATE TOOLBOX FOR MICROSCOPY & MICROANALYSIS

With the arrival of the MountainsSpectral® product family, version 9 opens a new range of possibilities for microscopy and spectroscopy data analysis, in particular for correlative analysis.

Multichannel cubes of compositional data can now be loaded thus allowing users to associate tomography and chemical analysis.

Data from different sources (SEM, AFM, EDS/EDX etc.) can be brought together to form single multi-channel datasets. A new color mixing tool allows users to choose which channel(s) of data they wish to bring to the fore.

Scanning electron microscope users can now generate spectacular 3D renderings associating EDS/EDX maps or other spectral/compositional data with SEM images or reconstructed topography when available.

3D rendering associating EDS map + SEM image
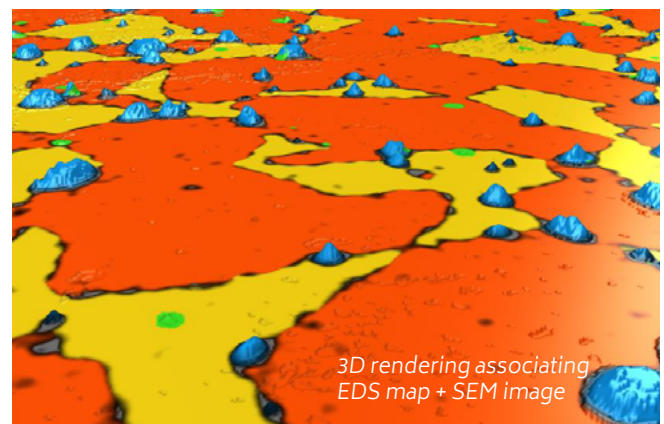
▶ **Join us for a sneak peak**
With the cancellation of in-person events preventing us from widely exhibiting this upcoming version release, we are thrilled to bring you an exclusive demonstration of new Mountains® 9 capabilities in webinar format.
Join us on Thursday May 6 @4PM. Sign-up here: bit.ly/3v8S2rx

How to update to Mountains® 9 (available June 2021)
Access to this latest release is included in the Mountains® Software Maintenance Plan (SMP). Please visit www.digitalsurf.com/support/software-updates
To find out more about SMP options, please contact sales@digitalsurf.com

CHARACTERIZING ANTIMICROBIAL SURFACE TOPOGRAPHY

It is well known that the current COVID-19 pandemic represents a serious problem for global health systems. Because of this, the control of surface-transmitted infections is highly desirable. A group of **researchers from the University of Ferrara, Italy,** defined a general procedure to characterize new materials obtained by anodic oxidation[1]. These types of surfaces, due to their nano-porous structure, act as reservoirs of silver ions which in turn confer antimicrobial properties to the surfaces. **Anna Nastruzzi,** one of the researchers involved in the study, explains more.

"We recently investigated different approaches for surface modification with the aim of reducing contamination, including the use of biological active metals" explains Anna Nastruzzi, Materials Science Engineer.

"This approach appears particularly interesting because the obtained material has an appropriate balance between the antimicrobial and mechanical properties, both of which are suitable for engineering applications.

In order to explore the potential of anodized aluminium alloys, our team investigated the tribological, anticorrosive and antimicrobial performances of a new material obtained by an innovative anodic oxidation, defined as Golden Hard Anodizing GHA.®" she says.
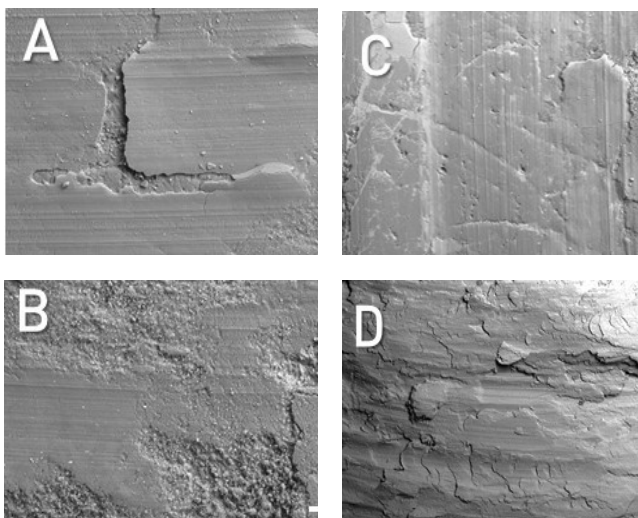

Figure 1. Representative SEM images relative to the pin-on-disk wear tests on GHA specimens. The images are relative to analyses showing different mechanisms of wearing such as: delamination (A), three body (B), abrasive (C) and tribo-oxidative (D).

ANALYSIS OF ANODIC OXIDE AND GHA MATERIALS

The laboratory of the Metallurgic Group within the Department of Engineering and the Laboratory of Biomaterials and Encapsultion (BEL) within the Department of Chemical, Pharmaceutical and Agricultural Sciences, both at the University of Ferrara, performed a series of tribological determinations through 3D wear trace reconstruction (profilometric analysis). In addition, the morphology of the wear surfaces was studied by means of a scanning electron microscope (SEM) and EDS analyses.

"The different analyses that were carried out by our team were performed using a non-contact profilometer and processed with MountainsMap® software. We employed the following operators in our workflow: spatial filter, fill in non-measured points, form removal, 3D surface reconstruction of the analyzed area and extracted profile.

By using a non-contact profilometer, we were able to investigate the surface topography before the tribological tests and, at the end of the tribological tests, to scan and acquire each wear track".

The surface topography was expressed by the parameters Rz, Ra, Rq, Rsk and Rku. "Rsk is particularly important as it gives information on the morphology of the surface texture" Nastruzzi explains. "Positive values correspond to high peaks spread on a regular surface (distribution skewed towards the bottom) while negative values are found on surfaces with pores and scratches".

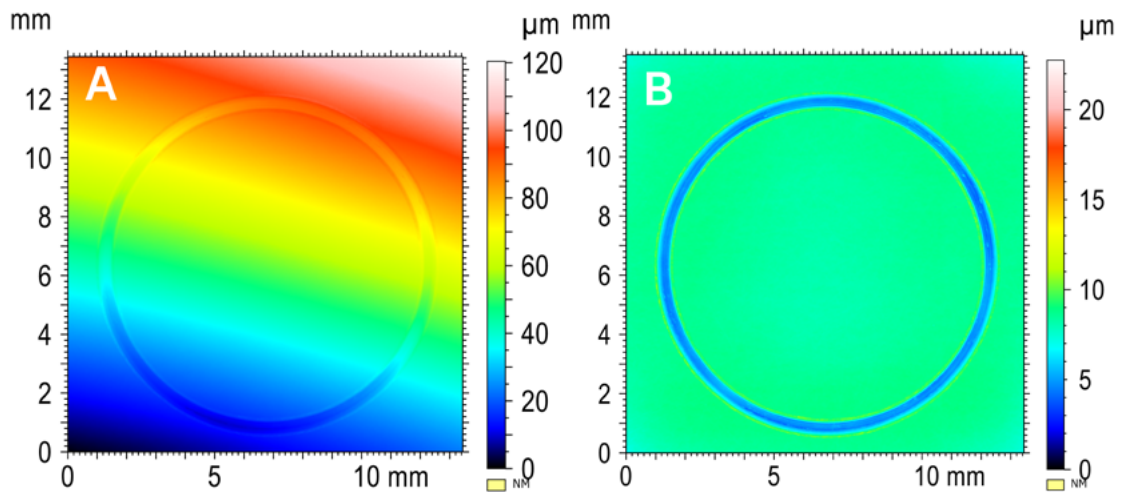[1] An electrochemical method for the production of an oxide film on a metallic substrate.

Figure 2. *Three-dimensional wear trace reconstruction process performed by Mountains® software to calculate the area of the wear trace after pin-on-disk tests. (A) Raw Pseudo-colour image, (B) image after filtering (Filter Median Denoising 3x3) and form removal (Form removed: polynomial of order 4).*

"With the help of Mountains® software, we were also able to calculate the wear volume, starting from the (2D) pseudo-colour view (see figure 2A, above) and by applying the filtering and form removal operators (see figure 2B, above). Finally, the volume was computed by multiplying the cross-sectional area by the wear distance".

CONCLUSION

"We found GHA to be a material with intrinsic antimicrobial properties and elevated mechanical, tribological and anti-corrosive features. Its treatment with silver ions is of significant importance in reducing the risk of contamination and preventing epidemic outbreaks.

In this study, MountainsMap® software was successfully used to characterize the GHA in view of its final application. Notably, it allowed for the determination of the initial roughness and of the wear rate by calculating the wear track area".
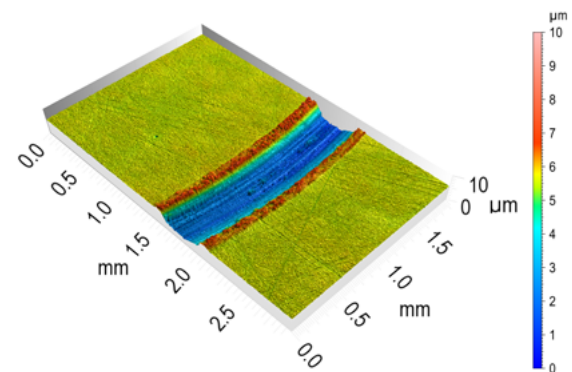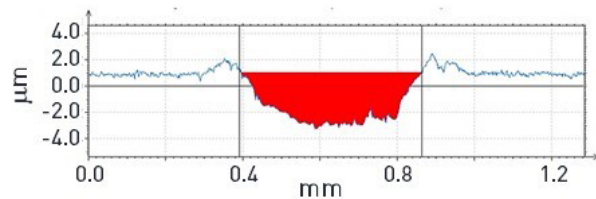

Figure 3. *3D view of the wear track.*

Figure 4. *Extracted profile and cross sectional area evaluation.*

INSTRUMENTS AND SOFTWARE USED

Non-contact 3D optical profilometer, scanning electron microscope + MountainsMap® software.

ABOUT THE AUTHORS

Anna Nastruzzi (Laboratory for Nuclear Materials), **Franco Cicerchia** (G.H.A. Europe s.r.l), **Annalisa Fortini** (Department of Engineering, University of Ferrara) and **Claudio Nastruzzi** (Department of Chemical, Pharmaceutical and Agricultural Sciences, University of Ferrara).

READ MORE

Gold hard anodized (GHA) materials with antimicrobial surface properties: mechanical, tribological, and microbiological characterization. *Nastruzzi, A., Cicerchia, F., Fortini, A. et al.* doi.org/10.1007/s42247-021-00180-y

STUDY HEIGHT DISTRIBUTION
## ABBOTT CURVES & HISTOGRAMS

The Abbott curve study in Mountains® allows users to display statistical information about height values, using two different graphs: the histogram and the Abbott-Firestone curve. Mountains® 9 sees a considerable number of improvements to these tools, useful to both profilometry and scanning probe microscopy users. **Isabelle Cauwet, in charge of Applications & Methods at Digital Surf**, explains more.

The first graph is the Height (or depth) distribution, displayed as an Histogram, which gives the probability (frequency) for points to be at a given height (depth). A bin of the histogram is defined by its width (height or depth interval) and its frequency.

The second graph is the Abbott-Firestone curve, which displays the material ratio in function of the Height. The material ratio is the percentage of the surface above a given height. The Abbott-Firestone curve is the cumulative curve of the distribution.
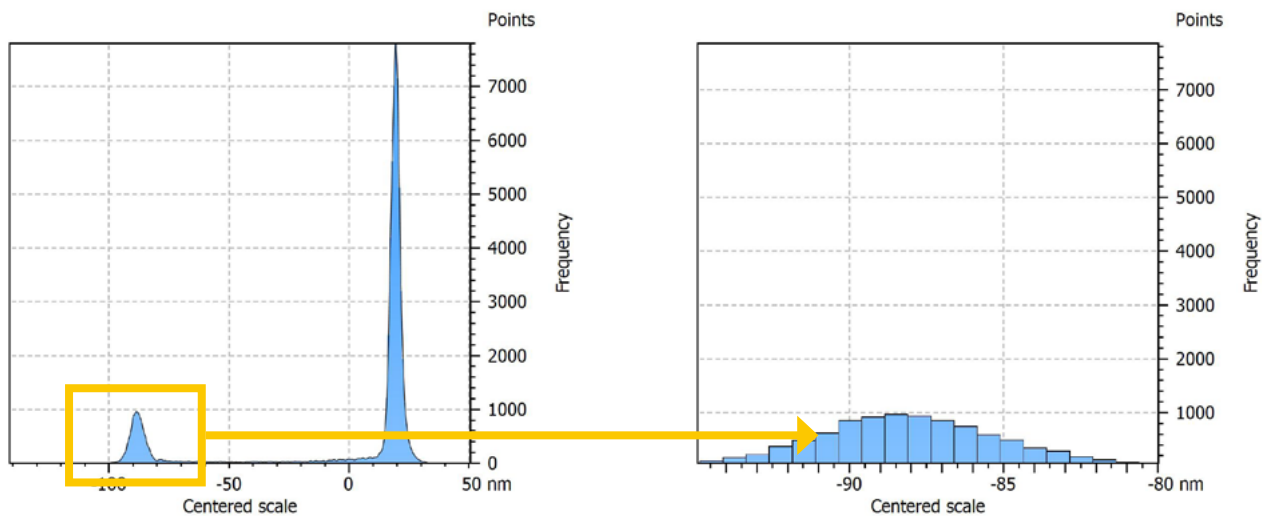
The Abbott-Firestone curve is widely used in profilometry for predicting functional behaviors of mechanical components. For example, the shape of the curve can be correlated to functional properties such as sealing or lubrication.

On the contrary, the SPM community does not use the Abbott-Firestone curve, but is familiar with the height histogram, for example to display information about particle height, atomic planes or flatness of a chemical deposit.
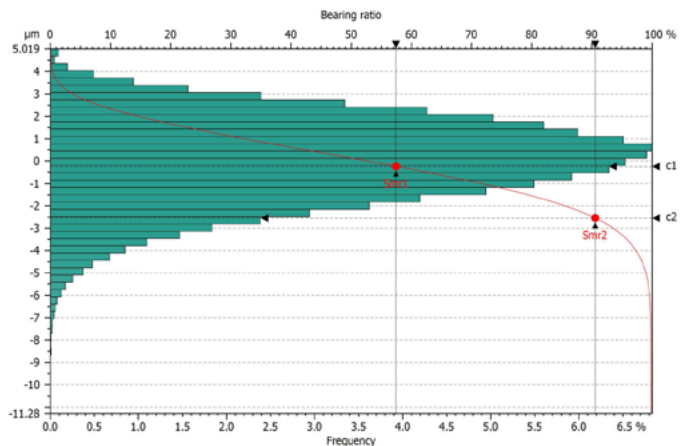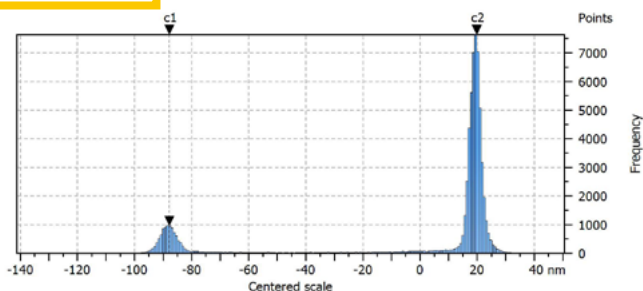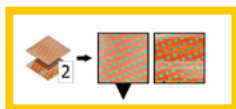

Individual cursors	Unit	c1	c2
Height	µm	-0.2387	-2.546
Pmr	%	57.42	90.54
Frequency (in points)		16624	6255
Frequency (in %)	%	6.342	2.386

Cursor pairs	c2-c1	Unit	
Height difference	-2.307	µm	
Pmr difference	33.12	%	
Number of points between cursors	86811		

Above. Visualization of Smr points

Above. Zoom in on a portion of the histogram to see details

Information	
Channel	* Waffle * (1 / 2)

Individual cursors	Unit	c1	c2	
Height	nm	-87.83	19.85	
Smr	%	91.92	31.68	
Frequency (in points)	points	954	7632	
Frequency (in %)	%	1.456	11.65	

Cursor pairs	c2-c1	Unit	
Height difference	107.7	nm	
Smr difference	60.24	%	
Number of points between cursors	39480	points	

Above. Switch between histograms in interactive mode when working with multichannel data such as AFM images.
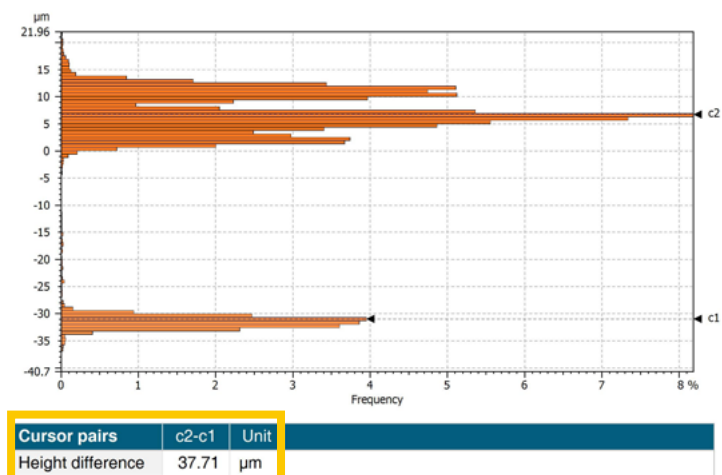
IMPROVED USABILITY AND NEW FEATURES

Version 9 introduces new features to the study. It is now possible to

► zoom in on the graph to reveal details (see above)

► automatically set the number of bins

► visualize the Smr parameter (areal material ratio) on the curve (see left).

SPM users will appreciate being able to have the histogram immediately displayed horizontally (whereas in profilometry, the height axis is vertical). Also to note: the interactive feature is now available for use when working with multichannel studiables.

All users will benefit from the automatic step height calculation from the histogram peaks, the display of individual bin values and the ability to show bin frequencies in number of points instead of percent.

TWO PREDEFINED BUTTONS FOR THE SAME STUDY

Two different buttons are now displayed in the Studies ribbon: "Abbott curve" and "Histogram analysis".
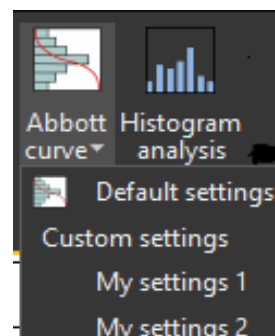
The availability of each tool depends on the product level.

Both buttons generate the same study, but the result is configured differently: the Abbott curve is displayed with a vertical height axis, the Histogram with a horizontal height axis.

As usual in Mountains®, settings can be customized and saved for later use: this means you can save and re-apply your own customized settings (color, displayed parameters, bin direction, imposed scale etc.) and save time when performing the same kind of analysis subsequently.

At Digital Surf, we are keen to continuously improve our products in particular by taking into account user needs and requests. It is also important to us to maintain the architecture integrity of the software and ease-of-use of the user interface, for the benefit of users in all our application fields.

Below. Automatically calculate height difference from histogram peaks

Cursor pairs	c2-c1	Unit
Height difference	37.71	μm

▶ SEE IT IN ACTION

We'll be presenting the new Abbott curve and Histogram features in our upcoming webinar on Mountains® 9.

See you there Thursday May 6 @4PM. Sign-up here: bit.ly/3v8S2rx

HOW IS SURFACE TEXTURE
INDICATED ON DRAWINGS?

Technical drawings use a standardized graphical language that allows subcontractors to understand designers' intent. They contain size and position specifications, dimensional tolerances and often surface texture tolerances. The technical drawing is a contract binding the parties, that acts as a reference in case of disputes about non-compliance of the produced workpiece. Digital Surf's **senior metrology expert François Blateyron** explores the subject.

Surface texture specifications are indicated using the root symbol. This root symbol is defined in the ISO 1302 standard (latest version published in 2002). The new ISO 21920-1 series will soon replace this standard with several changes that may modify common practices.

ROOT SYMBOL

The specified parameter should be placed under the root symbol with, at the very least, its limit value (see figure 1 below). These parameters are defined in ISO 4287, ISO 13565 or ISO 12085. Many other indications are defined by default and can be omitted on the drawing.
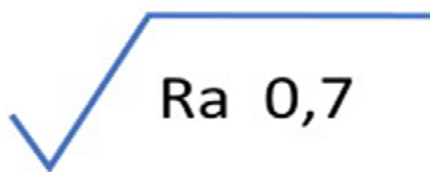

Figure 1. Specified parameter with its limit value.

When values other than the defaults are required, they must be written explicitly. For example, in figure 2. below, the bandwidth is defined with a cut-off of 0.008mm (8µm) for λs and a cut-off of 2.5 mm for λc.
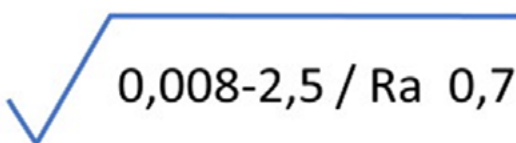

Figure 2. Specified parameter with a defined bandwidth.

The specification string under the root symbol may be very long for some parameters, which makes its interpretation difficult.

HIDDEN DEFAULTS

The type of filter is not written in the previous example because it is the default filter (Gaussian filter, according to ISO 16610-21). The decision rule is also the default one, the 16% rule, defined in ISO 4288:1996.

All these defaults need to be understood both by the designer when creating the drawing, and by the metrologist during the verification process. Unfortunately, this is usually not the case and many misinterpretations may lead to disputes and ultimately may result in great cost.

An explanation of decision rules and hidden defaults on drawing indications can be found in the following video: www.youtube.com/watch?v=c1o9U1_ttKQ

Another important hidden default is the fact that parameters are calculated on several sampling lengths and averaged. By default, five sampling lengths are used. This aspect is usually taken care of by analysis software packages, but users need to understand the reasons behind it.

With five sampling lengths and a cut-off of 0.8mm, the analyzed profile will only be 4mm long (5x0.8mm), even if the user measured a profile of 16 mm. When needed, designers should adapt the evaluation length to the area of the workpiece on which they put the roughness specification, and explicitly write a longer evaluation length on the drawing.

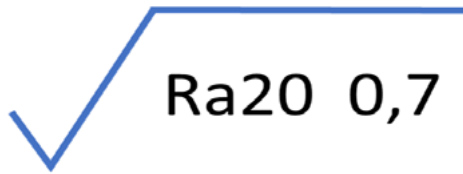In figure 3 (see following page), for example, the evaluation length is 20x0.8mm = 16mm.

Figure 3. Example of a parameter calculated on several sampling lengths.

A video tutorial on parameters calculated according to ISO 4287 can be found here: www.youtube.com/watch?v=Ay7Vzw0U-uI

The new ISO 21920 will drop the average over sampling lengths for most parameters, but it will still define the evaluation length as a multiple of the cut-off, with a default number of 5xλc... unless the draft standard is changed before its publication!

NEW ROOT SYMBOLS

The good news is that specifications relying on the new standard (ISO 21920) will use a modified root symbol with a dash line above the triangle. Drawings with this new symbol should be interpreted according to ISO 21920 (parts 1 to 3) whereas if the old symbol is used, drawings should be interpreted according to ISO 1302, ISO 4287, ISO 4288. Another modified root symbol, with a skewed square, refers to areal specifications according to the ISO 25178 series.

Figure 4. New root symbols and corresponding standards.

POSITION OF THE PARAMETER

Another big change introduced by the new standard is the position of the parameter and its limit under the root symbol. With ISO 1302, the parameter was written after the oblique bar to separate it from the bandwidth specification (see figure below).
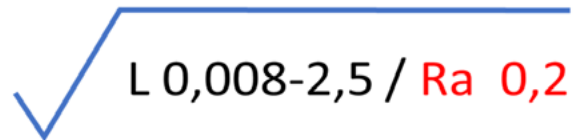

Figure 5. Expression defined by the ISO 1302 standard.

With the new standard, the parameter and the limit are written first, for better clarity. The rest is written after an oblique bar (see figure 6, below).
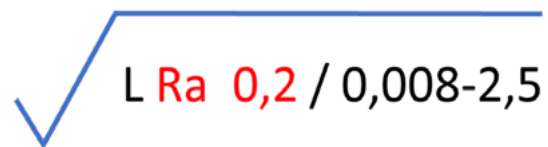

Figure 6. Updated expression defined by ISO 21920 standard.

UPDATE YOUR PRACTICES

These changes aim to simplify things, but at the same time they require users to update their knowledge and practices.

In order to avoid misinterpretations, the need for education and training is higher than ever. This is the mission of our **Surface Metrology Guide** which is freely available on the web.

ADDITIONAL RESSOURCES

▶ ***Indication of surface texture on technical drawings:*** *guide.digitalsurf.com/en/guide-indications-iso-1302.html*

▶ ***ISO 1302:2002:*** *Indication of surface texture in technical product documentation.*

▶ ***ISO/DIS 21920-1:2020:*** *Surface texture: Profile — Part 1: Indication of surface texture.*

▶ ***ISO 14253-1:2017:*** *Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for verifying conformity or nonconformity with specifications.*

▶ ***Surface Metrology Guide:*** *www.digitalsurf.com/guide*

EVENTS HIGHLIGHTS

"

TRADE SHOWS & CONFERENCES IN THE VIRTUAL REALM

The **MRS Fall meeting and exhibit** traditionally takes place in Boston, MA in December. This conference dedicated to materials research gathers scientists and researchers from all over the world every year. For its 2020 edition, MRS, like many other events, was faced with the consequences of the Covid-19 pandemic and a full virtual meeting took place from **November 27 to December 3**.
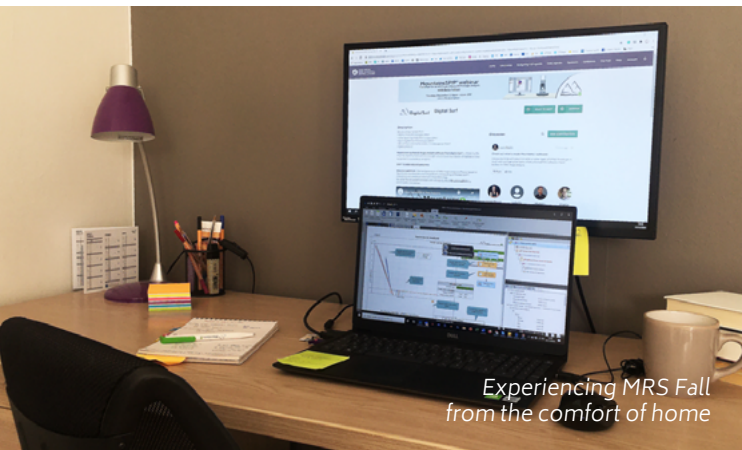
*Experiencing MRS Fall
from the comfort of home*

Thanks to a dedicated platform, the 5,600 attendees could follow a large program of scientific presentations and visit virtual exhibit booths from the comfort of their home or office.

The Digital Surf team was thrilled to participate in this virtual exhibition. Arnaud, Isabelle, Mathieu and Nicolas were happy to stay connected from their living room and provide our visitors with remote demonstrations of the latest version of Mountains® software.

During this event, Digital Surf broadcasted a brand new webinar dedicated to SPM users to help them in the transition from SPIP™ to MountainsSPIP®. The webinar was presented by Dalia Yablon, renowned expert in the field of AFM, and recorded over 220 registrants.

Early Spring, Digital Surf took its first (again, virtual) steps at **Pittcon**. Pittcon is the world's leading conference on analytical chemistry and applied spectroscopy. Although originally planned to take place in Pittsburgh, PA, the conference went online for the first time this year.

Alongside 180 other companies, the Digital Surf team was very excited to be exhibiting at this event from **March 8 to 10, 2021**. Arnaud, Nicolas and Renata were on hand to welcome visitors to the virtual booth and give them more details about Mountains® key features for microscopy or spectroscopy data analysis.

It's always a great pleasure to connect with our customers and partners, even if we still have to do it virtually for now. A big thank you to all those who continue to follow our events remotely. We look forward to meeting you in person very soon. Stay safe and healthly!

*Digital Surf's booth at
Pittcon 2021*

WHAT'S HOT ONLINE

NEW ON FACEBOOK

Our team recently headed to the Institute of Electronics, Micro-electronics and Nanotechnology (IEMN) in Lille, France for an exciting collaboration.

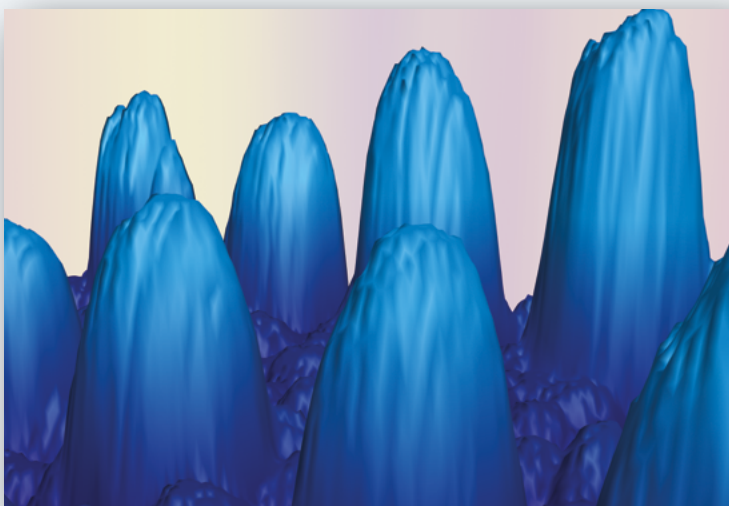To find out more, stay tuned: bit.ly/3s3gBUJ

POPULAR ON INSTAGRAM

It's quite something when the micro-world resembles the visible world. Curious as to what these aluminum nanoparticles mirror in nature? Head over to our Instagram page to find out: bit.ly/3uZb-WVP

Have you visited our YouTube channel recently?

Check out our channel for tutorial videos on surface analysis and SEM & SPM image analysis, with Mountains® software!

bit.ly/2U2I2za

Surface Newsletter

Know a friend or colleague who would be interested in receiving the *Surface Newsletter*?
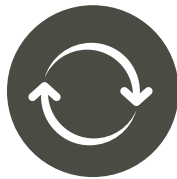Let us know :
contact@digitalsurf.com

The newsletter is available for download on our website
www.digitalsurf.com

Useful LINKS

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Take Mountains® for a test drive
Visit www.digitalsurf.com/free-trial

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Contact sales@digitalsurf.com for information about updating
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LEARN SURFACE METROLOGY

Dive into our free online surface metrology guide
and learn about characterizing surface texture in 2D and 3D
www.digitalsurf.com/guide

CATCH UP WITH US ONLINE

Get an exclusive look at the new Mountains® 9 version in our
upcoming webinar: What's coming in Mountains® 9.
Join us on May 6, 2021 4:00 PM CEST. Register here: bit.ly/3v8S2rx

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Digital Surf