OLYMPUS

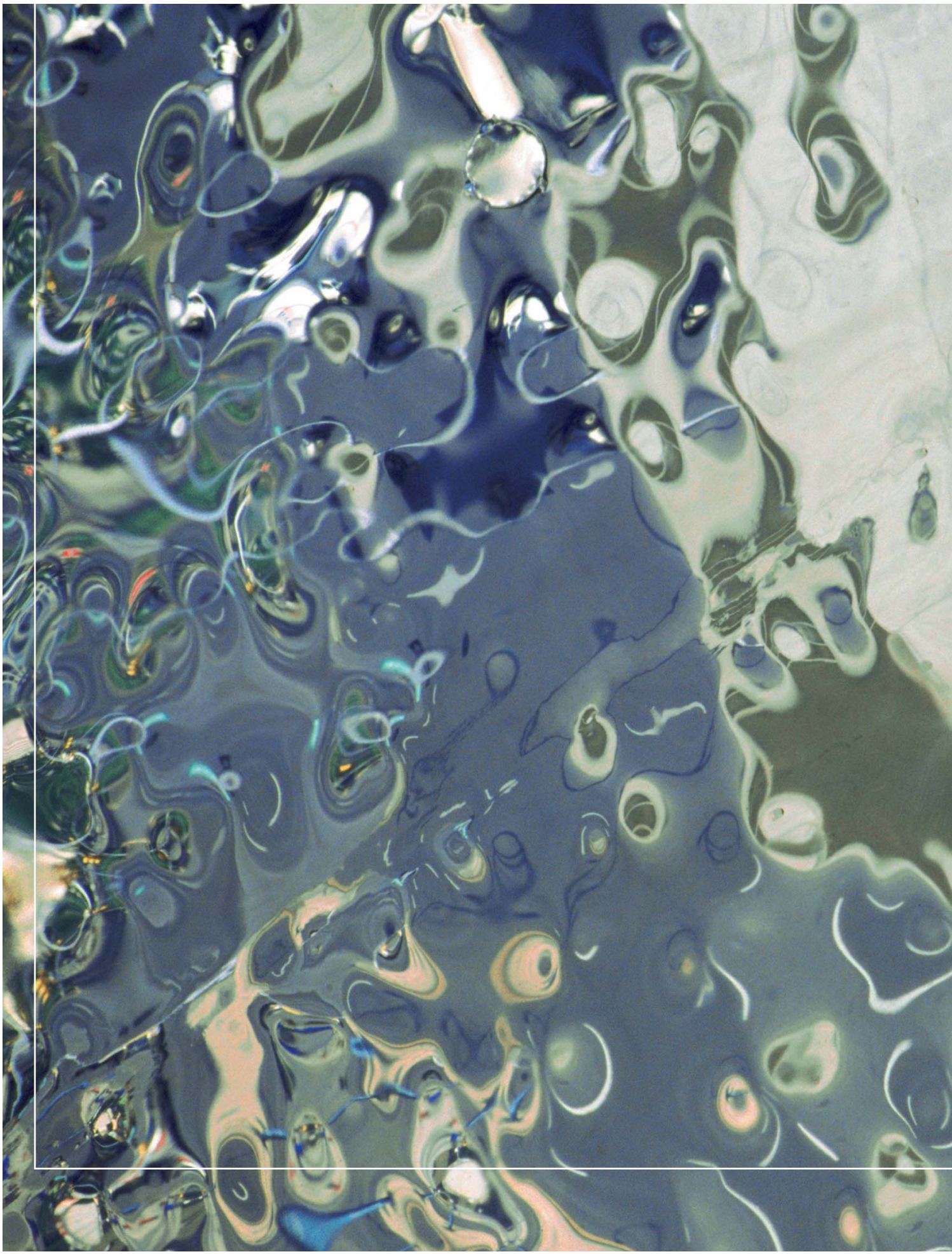
Your Vision, Our Future

Digital Imaging Solutions

analySIS

analySIS Family

Image-Processing Solutions for Materials Science Applications



TAKING PROVEN METHODS DOWN NEW PATHS

Reliable, reproducible and objective

Quality requirements are extremely exacting – for the automotive sector, aviation and aerospace technologies, the semiconductor and electronics industry, plant construction and analytical and industrial metallography. Quality and process assurance are based on proven methods, on experts' knowledge and evaluatory skills as well as on strict national and international standards. Digital microscopy and image-processing technologies play a major role here, lessening the effort required for manual and visual tasks and optimizing processes. This is the only way to successfully meet steadily rising demands regarding product quality, process assurance and economic profitability. Familiar inspection methods can be automated and thus be conducted faster and more ergonomically. Today's microscopy and image-processing systems offer significantly higher objectivity and reproducibility than conventional methods. The results are more precise, more reliable and are obtained faster.

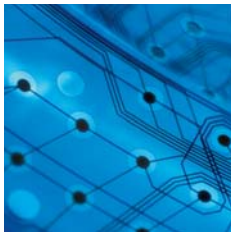
Practice-oriented – the modular platform

Working jointly with well-known firms and experienced users from an enormous range of industry and research sectors, Olympus has developed specialised image-processing solutions for metallographic applications. The aim is making lab workflows as efficient as possible. The result? A family of software products so broad in scope that it spans the range of tasks today's materials labs are faced with – received orders to analysis and report generation. Each member of this family can be expanded due to its modular structure. Users will note that they are operated in the same way – be it basic image acquisition and documentation or complex image analysis and documentation. All functions are grouped in a logical fashion. This family of products also offers application-specific comprehensive solutions, the Inspector series and digital cameras specially designed for metallography demands.

RANGING FROM BASIC IMAGE DOCUMENTATION TO AUTOMATIC INSPECTION SYSTEMS

Digital solutions for everyday usage

In today's global markets, stiff competition and steadily rising demands regarding product quality affect the entire production sector. Digital technologies take manual inspection processes and make them more efficient or replace them entirely, thus enhancing product quality. Inspection costs are either the same or even reduced.



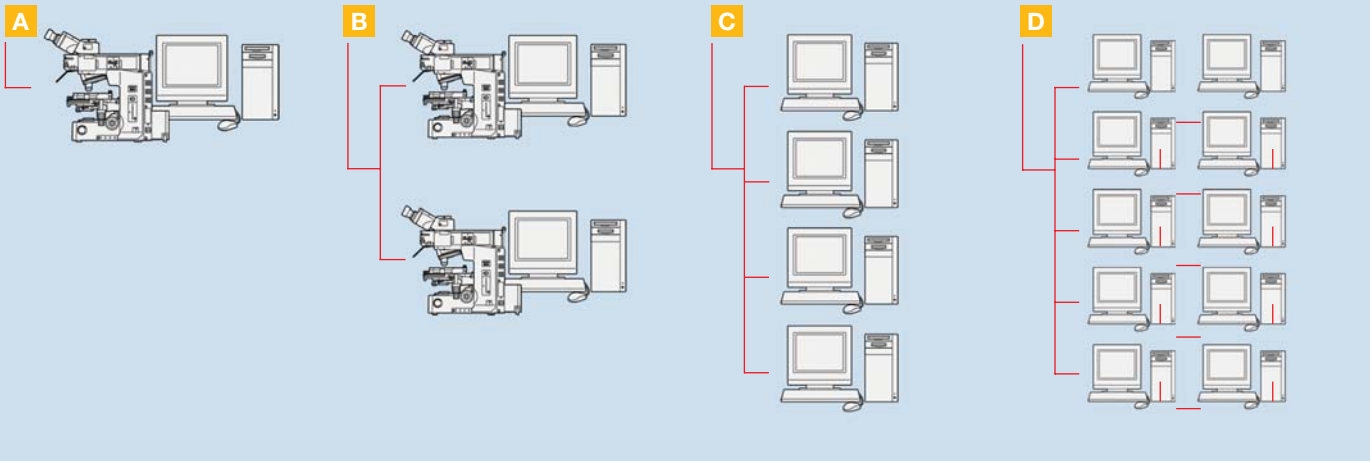
Lasting success

Olympus has years of experience as a partner to users around the globe, providing comprehensive image-processing, camera and microscope solutions which meet the most demanding requirements. Our research and development teams, our production units, and our sales and customer support departments are all working hard towards one goal – facilitating our customers' lasting success.

THE MATERIALS SCIENCE IMAGE-PROCESSING SOFTWARE

Get exactly what you need!

Carefully designed comprehensive solutions for optimising workflows, offering concentrated functionality without any unnecessary extras – we place an enormous range of potential application areas with routines used day in, day out at labs everywhere at users' fingertips. This is what our analySIS materials analytical platform and all members of this family are all about. analySIS is a name that stands for quality – for flexible and high-performance software solutions for materials labs performing the following tasks: acquiring and processing images digitally; analysing, evaluating and archiving them; managing related documents and finally generating reports. analySIS offers specially designed, intuitively operated image analysis applications for materials testing labs. analySIS has a broad spectrum of solutions – basic single workstation solutions for entry-level and advanced tasks; value-for-money multi-user systems; and complex networking of entire labs hooked up to company intranet, extranet and Internet systems.



E Software protection device

Dongle

OLYMPUS ANALYSIS – CORE CONCEPT, STRUCTURE, DESIGN

A All five members of the Olympus analySIS series for materials sciences have a common basic functionality. The concept and architecture of this platform have been carefully honed to meet the demands and requirements of digital image analysis today. The latest know-how as well as users' proven methods and workflows are a continuous source of input for the development of this platform's range of functions. The analySIS family of products redefines user-friendliness with its simple and intuitive operation, finely attuned functionality and flexibly modular structure. Furthermore, all analySIS products offer tremendous image and data display advantages, guaranteeing effective image and data processing.

Multi-workstation system

B A secondary licence is essentially the same as a primary licence, but is available for a special price which depends on the number of secondary licences purchased.

Workstation licenses

C More and more users are realising that doing image and data acquisition at the microscope and subsequent processing at other workstations is the most efficient way to go. This is why additional workstation licences may be purchased along with an analySIS primary license. Secondary licences are essentially the same as primary licences aside from not having image acquisition. Users can work with the software just like at the microscope but are not limited by restricted access to the microscope. All data can be accessed via a networkable database.

Network licences

D E The Olympus analySIS series is protected using a software protection device known as a dongle. Instead of supplying every computer with a separate dongle, a network dongle can be used. This "net hasp dongle" permits operation of the analySIS licences purchased in a network under Windows 95, 98, WinNT 4.0, Windows 2000 and Windows XP. WinNT 4.0 servers, Windows 2000 and Windows XP servers can have the "Licence Manager" installed on them. This eliminates the need for users to log on within the network.

ANALYSIS START

analySIS start is a high-performance system for image acquisition and complete software control of camera and microscope. Using analySIS start, perfect images are acquired, particles counted, dimensions measured, distances calculated and much, much more – all at the push of a button.

So easy to use

F G analySIS start redefines what image and data display is all about. User-friendly operation is another attractive aspect of analySIS start. ViewPorts are windows for viewing one or more images. ViewPorts can be used totally independently of each other and offer a wide scope of ergonomic viewing and configuration options. Interpreting image contents is much easier with the multiple view feature where various areas of the same image can be viewed at different zoom levels simultaneously. Synchronising ViewPorts enables users to compare images on-screen. The navigator ensures that even when viewing large images at high zoom levels, users always know where they are. analySIS start supports a great number of file formats (incl. multidimensional image formats). It also offers numerous options for adding graphic elements and text comments to images.

Optimising live images in real time

During image acquisition, numerous real-time functions ensure optimal image quality. These functions run automatically in the background and can be switched on or off by the user as needed. These include functions for ensuring the entire dynamic range of the camera is used and preventing over-illumination within the image. analySIS start corrects vignetting in colour and monochrome images in real time via shading images (which need acquiring just once). In addition, intensity integration, averaging and the autofocus function make sure image quality is the best possible. Comments, images and texts can be added to an image directly and interactive measuring can be done within live images.

Automatic correction of image misalignment when switching objectives

H When an objective is switched, microscopes often have a mechanical image misalignment. analySIS start offers automated XYZ position corrections which ensures that once an object has been centred, it stays that way at every magnification.

Controlling microscope and experiment

analySIS start operates a wide range of high-resolution and light-sensitive cameras as well as the Olympus motorised microscope series – the BX, MX, GX and SZX. The remote functions enable users to operate these devices precisely. All device parameters are read out and recorded along with other image information.

Software autofocus

Software autofocus for the Olympus BX61 automated microscope series is perfect for routine work at the microscope. It is also ideal for use with automated applications. The algorithm used directly controls the microscope's motorised focus drive.

Image labelling

I analySIS start includes a comprehensive library of text, graphical and editing functions for labelling and highlighting images.

Basic measurements

analySIS start offers basic measurement functions for counting particles interactively and measuring dimensions and distances.

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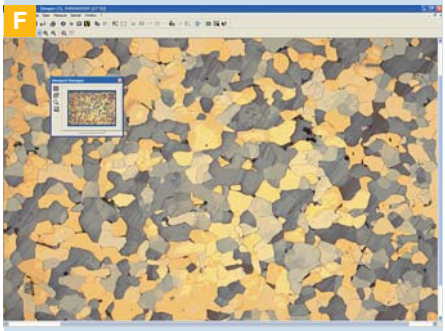

ViewPort with full screen view

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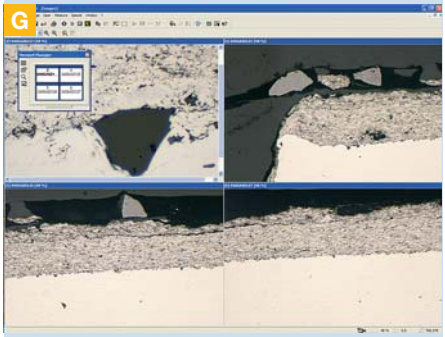

ViewPort with split-screen (four fields)

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Objective parameter setting

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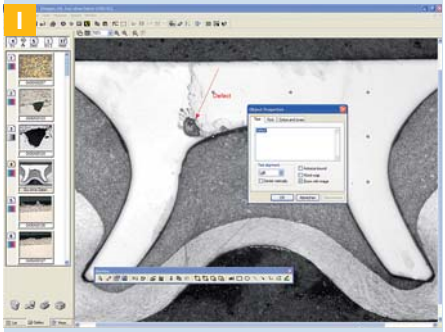
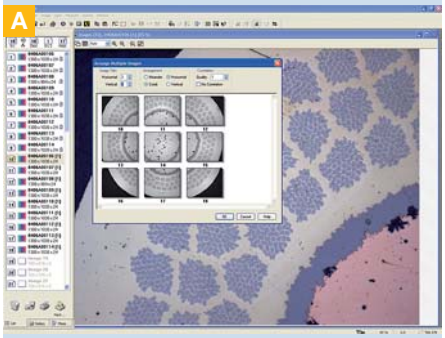


Editable image labelling with text and graphical functions

ANALYSIS WORK

Alongside the analySIS start functions, analySIS work offers what users need for all elementary metallography tasks. Just like analySIS start, there's image acquisition, and analySIS work has an extended range of interactive measurement functions as well as structured archiving and professional report generation.



Overview image generated from 9 single images

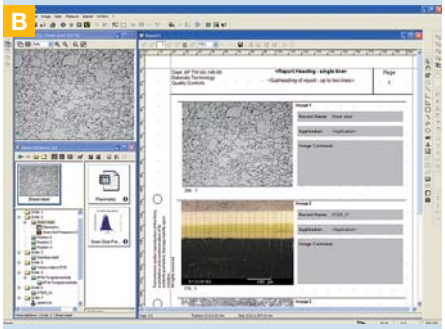


Image database

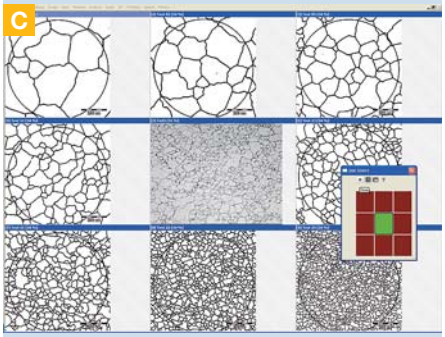
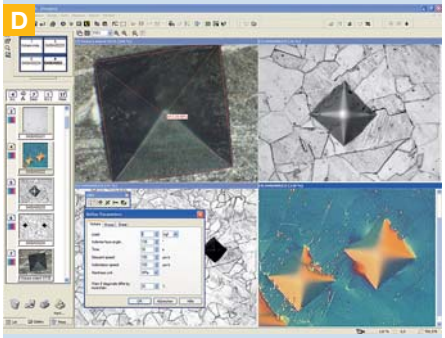


Chart comparison



Micro hardness testing by analysis of a Vickers imprint

Overview acquisitions at highest resolution

A Particularly when working at extremely high magnification, structures users wish to acquire may be larger than the field of view of the camera. analySIS work offers a feature for generating large-format panorama images by acquiring multiple component images which are then automatically placed next to each other – thus creating a large overview image. Users no longer need to rely on objectives with low magnification and low resolution. Images acquired at neighbouring positions are stitched together seamlessly, resulting in a single, high-resolution panorama image.

Structured archiving keeps image database tidy

B The integrated image database archives images along with all analysis, process and documentation data. Images may be saved directly with texts, sheets and graphics. This means the whole acquisition and processing sequence is documented as a single unit. The database structure can be adjusted to suit users' own workflows. User-specific masks make inserting recurring data much easier and reduce the likelihood of erroneous data entry. The database's unique architecture ensures efficiency and speedy access to necessary data while keeping its network capacity requirements low.

Results documentation – easy and professional

B The report generator makes creating standards-compliant image charts convenient, quick and easy. These image charts are based on user and/or work group templates which can be defined just as users like or need them. The report generator supports graphical elements such as images, sheets and diagrams. Text fields may be filled in automatically with database field content or evaluation results. Numerous options such as standard magnifications and detail zooms are available for report generation. Simply dragging and dropping images from the database onto the report is all that is necessary to generate a report within seconds. The correct number of pages is generated automatically.

Chart comparison

C Chart comparison on the PC screen means it is possible to quickly and easily assign the live image to the relevant reference image as well as documenting object properties. This kind of chart comparison is ergonomic – even with highly detailed images – because the entire monitor is used for displaying reference images and the live image. Characteristic data (numerical or text) can be assigned to each reference image. This data can be transferred at a click of the mouse onto the results sheet. Various EN-ISO, DIN and ASTM charts are also available as extensions. Furthermore, users may define their own charts and integrate them into the chart pick list.

Microhardness testing

D The Knoop and Vickers methods are provided for determining hardness. Hardness is calculated based on evaluation of the indent diagonals. The resulting data can be shown in tables and/or diagrams. In addition, hardness profiles are generated.

ANALYSIS DOCU

analySIS docu is the most comprehensive documentation member of the analySIS family. This version offers numerous valuable image acquisition and image display functions in addition to all the functions analySIS work has. This includes acquiring images at infinite depth of focus and 3-D visualisation functions.

Acquisition of fast image sequences

analySIS docu offers fast image sequence acquisition. Image sequences are available as single frames within image stacks and may also be saved and archived as a whole film in AVI format. Live images can be transferred directly to the Internet from analySIS docu – with no extra hardware needed.

Processing graphs

analySIS docu offers processing, evaluation and display of graphs. Graphs can be labelled and shown using various views. Numerous filters and evaluatory functions are of assistance for further processing resulting data.

Infinite depth of focus

E Sidestep the limited depth of focus of high-resolution microscopes via analySIS docu. Images acquired at various focal levels have the sharpest areas extracted and combined into a new, razor-sharp image.

3-D visualisation

F Acquiring images at various height levels (z-sectioning) makes it possible to display samples three-dimensionally. The analySIS docu SliceViewer visualises image stacks generated in three dimensions. Users can manoeuvre within the 3-D image and take a virtual flight through their own specimens.

Image processing

analySIS docu contains all standard image-processing filters for monochrome and colour images – both as predefined and user-definable functions. In addition, the software has numerous specially developed tools and filters which open up new horizons with regard to image and data processing.

Interactive measurements and multi-phase analysis

G A unique evaluation environment for interactive measuring is included in analySIS docu. Results are shown in graphs and/or sheets. In addition, data is directly evaluated regarding average and extreme values along with standard deviations. Alongside basic measurement functions, analySIS docu also offers manual measurement via 2-D measurement parameters. analySIS docu also has quantitative multi-phase analysis for determining phase composition automatically and precisely – absolute and percentage values obtained via threshold analysis. Multiple phases may be evaluated in a single step.

Measuring layer thickness via arbitrarily shaped surfaces

H This method is for measuring the layer thickness of single and multiple layers of cross sections. During evaluation, the contour of arbitrarily shaped surfaces is tracked. The evaluated data is then shown including statistics and tolerances.

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Extended depth of field

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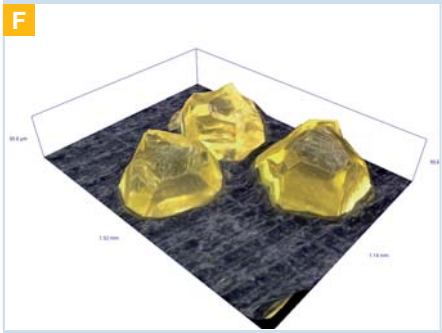
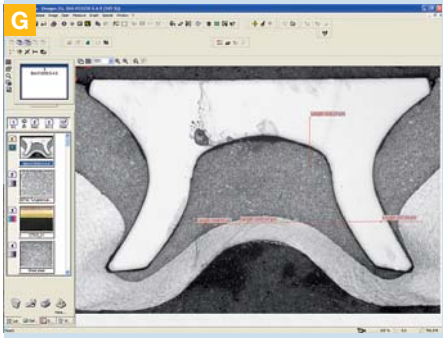


3-D view generated by overlaying height and image data

G



Interactive distance measurement

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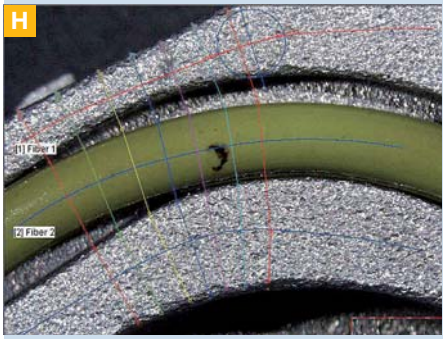
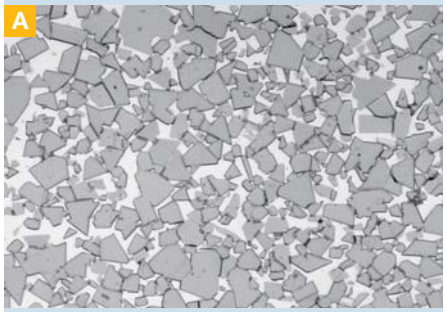
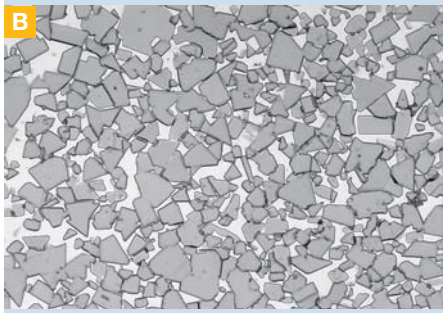


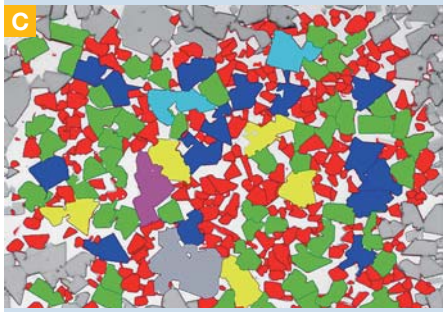
Layer thickness measurement of a curved fibre



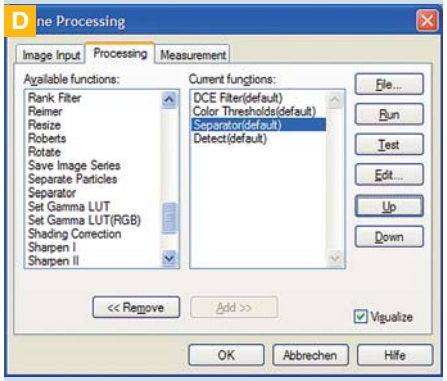
Particle analysis step 1: Image acquisition



Step 2: Image optimisation



Step 3: Analysis



Automation

ANALYSIS AUTO

analySIS auto offers many functions for particle-oriented image analysis with multifaceted classification options. Furthermore, fully automated execution of analysis sequences, including stage control, is supported.

Morphological filters

Morphological filters are for solving typical image analysis tasks such as detection of objects/particles within binary images. Sometimes a particle is split up via binarisation and thus unintentionally interpreted as two particles. Or there may be cases where adjacent particles have to be separated. The procedures used for these processes are based on morphological filters. Rectangular and hexagonal lattices are supported by analySIS auto. Erosion (removal of object pixels) and dilation as well as combinations and modifications of these methods are the primary morphological filtering procedures.

Particle analysis to suit your specific needs exactly

A B C The analySIS auto functions offer easy, fast and flexible image evaluation. High-performance particle detection is applicable to both black and white, and colour images. Particles can be analysed within entire images or within specific image segments – referred to as ROIs (regions of interest). There are various ways to treat particles occurring in border regions (clipping, inclusion, non-inclusion). Any alteration to detection settings is implemented immediately and displayed. Detection can also involve additional filtering according to various particle criteria. Setting specific filters for multiple particle parameters involves connecting them logically with an AND operator. All particle parameters are clearly explained via images and texts. Users can also define their own particle parameters.

Easy access to data of individual particles

All analysis results are displayed in sheets. These sheets may include detection results such as particle data, class data and/or ROI-related particle data. Every detected object has its own sheet line containing the corresponding results. A cleverly designed particle and sheet management function enables users to selectively analyse data and objects. As each particle has its own sheet line, users can easily identify particles via the corresponding sheet line or vice versa (via the particle within the image).

Automate process workflows

D analySIS auto supports automated process sequences. These are defined via the integrated “Automater” which requires no programming. Entire sequences are supported – specimen positioning, focusing, image acquisition, image prep and evaluation, data results and archiving. Recurring tasks can then be run at a mere press of a button.

ANALYSIS PRO

analySIS pro is the highest expansion level of the Olympus analySIS product series for the materials sciences. Complex image analysis tasks are effortlessly taken care of by analySIS pro and automatically finished, one after the other. New methods for tracking objects as well as for particle analysis via intercept are included. analySIS pro also offers an integrated software development environment.

Selective frequency filtering via fast Fourier transformation

E Via FFT (fast Fourier transformation), specific frequencies or frequency ranges of spatial directions within the actual image can be shown/hidden. A two-dimensional FFT including convolution and correlation is integrated with analySIS pro. Real parts, imaginary parts and phase are supported in FFT space. Annular, blob, lattice and sector filters are available and can be connected logically.

Grain-size analysis according to line-intercept method

F Analysing grain size using the intercept method is done via application of all standard line-intercept patterns. Horizontal, vertical, diagonal, circular and combined line configurations are supported. Grain size is determined according to accepted national and international norms. The basis for determining grain size is the mean intercept length. Light or dark borders are detected for individual grain phases. Stepped grain borders are detected for multi-phase materials. Analyses of grain-border samples and samples with etched grain surfaces are supported. Results appear in a sheet or graphically. This method can also be used for quantitative analysis of the average size of image objects.

Detect and track moving objects automatically

Motion analyses allow users to analyse motility. analySIS pro detects moving objects automatically and tracks them over time. The results can be presented in films of object paths, in sheets and in histograms with the following parameters: speed, direction, path length and distance.

Automate time-lapse investigations

When analysing dynamic processes via time-lapse investigation, it is essential to be able to automate the entire workflow – microscope control, data archiving and report generation. analySIS pro offers image sequence generation in various dimensions. The *x*, *y* and *z* axes of motorised stages are supported.

Automatic measurement of complex geometries

G analySIS pro has one of the most extensive tools available for automatic measurement of objects within digital images. Complex objects of any shape and size are measured precisely – microstructures on chips, holes on lamina or cross sections of electronic and mechanical components, injection-moulded parts or extruded window frames. The sequence of measurements is user-defined in a user-friendly dialogue.

Program your own custom-tailored solutions

H The Imaging C programming language offers experienced users a comprehensive developing environment. This includes a programming library with unrestricted access to a wide variety of analySIS pro functions along with a debugging environment.

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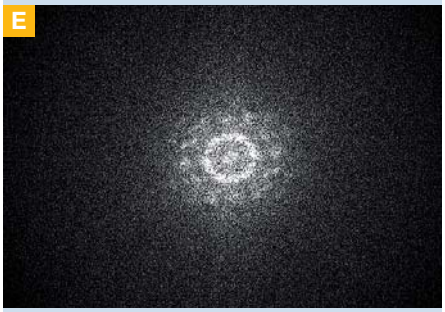

Graphical result display of frequency analysis with FFT

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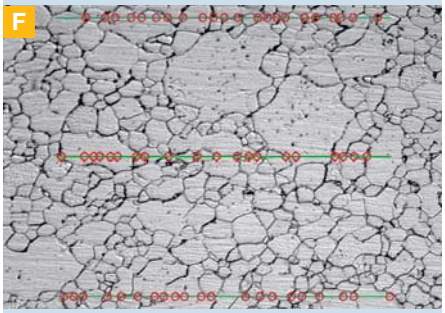

Grain-size analysis (intercept)

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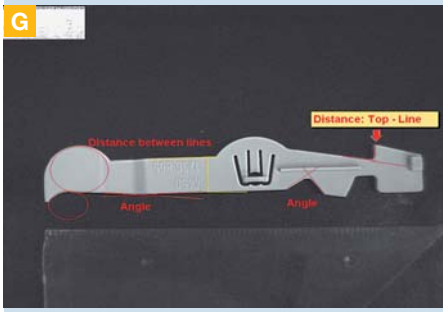

Automatic measurement of angles and distances

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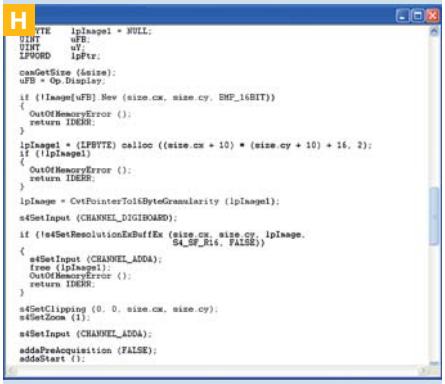


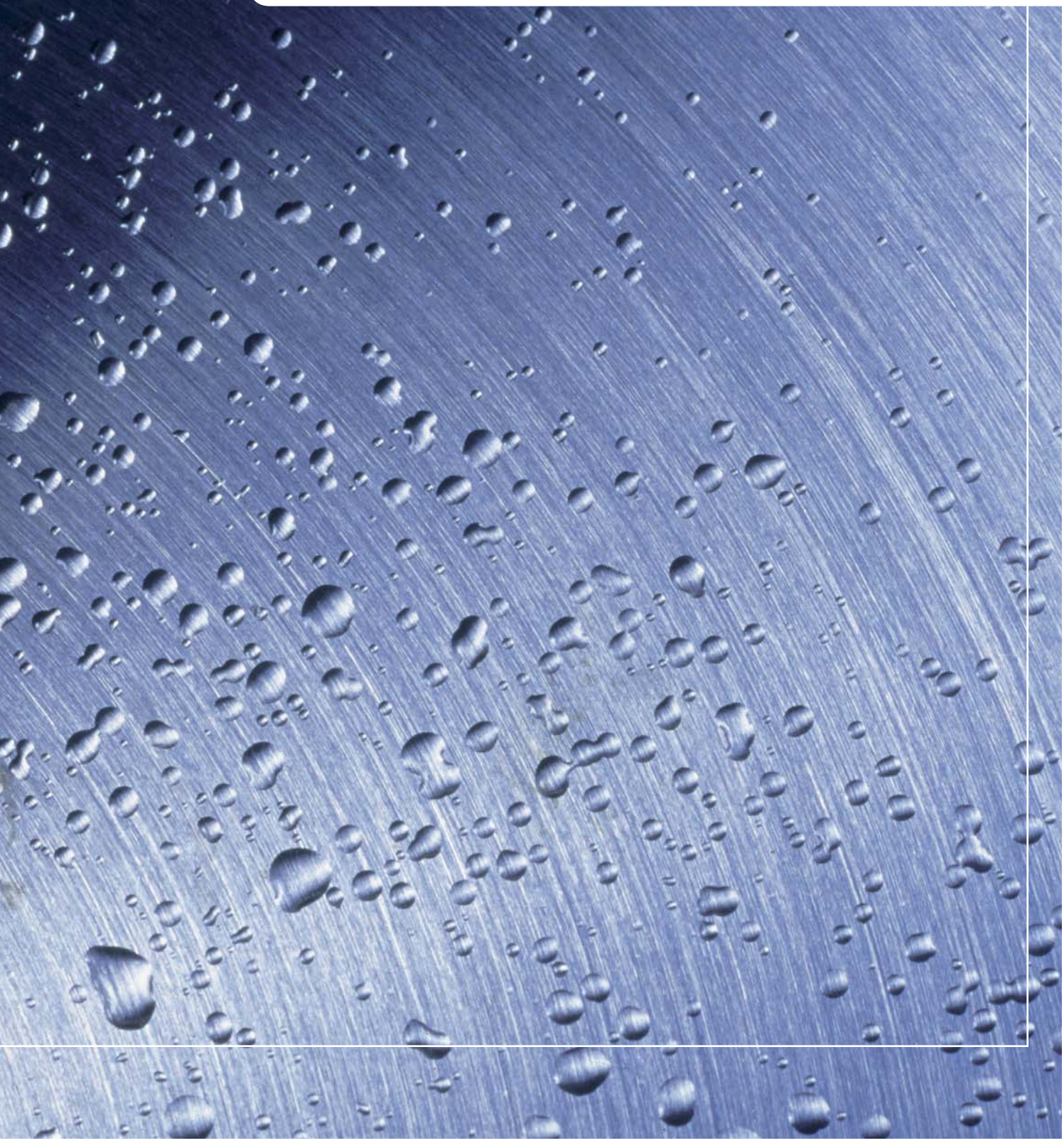
```
BYTE    lpImage1 = NULL;
UINT    uFB;
UINT    uY
LPWORD  lpPtr;

camGetSize (&size);
uFB = Op.Display;

if (!Image[uFB].New (size.cx, size.cy, IMF_16BIT))
{
  OutOfMemoryError ();
  return IDERR;
}

lpImage1 = (LPBYTE) calloc ((size.cx + 10) * (size.cy + 10) + 16, 2);
if (!lpImage1)
{
  OutOfMemoryError ();
  return IDERR;
}

lpImage = CvtPointerTo16ByteGranularity (lpImage1);

s4SetInput (CHANNEL_DIGIBOARD);

if (!s4SetResolutionExBuffEx (size.cx, size.cy, lpImage,
                              S4_SF_R16, FALSE))
{
  s4SetInput (CHANNEL_ADDA);
  free (lpImage1);
  OutOfMemoryError ();
  return IDERR;
}

s4SetClipping (0, 0, size.cx, size.cy);
s4SetZoom (1);

s4SetInput (CHANNEL_ADDA);

addaPreAcquisition (FALSE);
addaStart ();
```

Programming with “Imaging C”

APPLICATION-ORIENTED SOFTWARE EXTENSIONS

Perfect additions for specific metallography applications

The requirements, tasks and processes in metallography labs, research and development departments and in quality assurance and process control are as varied as they are numerous. That's why all products of the Olympus analySIS series, starting with analySIS docu, can be extended via additional software modules for specific applications. Each of these extensions works perfectly with the individual products of the family and with the other extensions as well.



ANALYSIS EXTENSIONS

The software extensions perfectly match the analySIS product family, thereby allowing to perform routine tasks in materials science efficiently and in accordance with international standards.

Grain-size analysis according to line-intercept method

A Analysing grain size using the intercept method is done via application of all standard line-intercept patterns. Horizontal, vertical, diagonal, circular and combined line configurations are supported. Grain size is determined according to accepted national and international norms. The basis for determining grain size is the mean intercept length. Light or dark borders are detected for individual grain phases. Stepped grain borders are detected for multi-phase materials. Analyses of grain-border samples and samples with etched grain surfaces are supported. Results appear in a sheet or graphically.

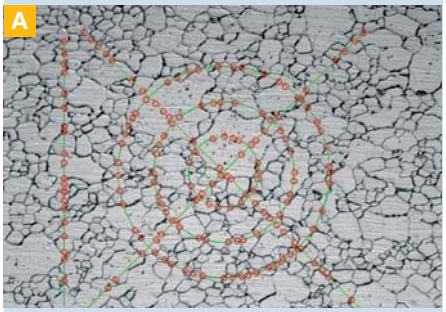
Planimetric grain-size determination

B The planimetric measurement method determines grain size via the area of the grains. For automatic analysis, grain boundaries must be continuous – i.e. unbroken. To ensure that boundaries are continuous, the planimetric method includes a high-performance algorithm for reconstruction of grain boundaries. The planimetric method allows the user to conduct analyses that go beyond the usual level of standard analysis: e.g. bimodal g-values, g-values of sandwich layers, g-value histograms, elongation. Thanks to integrated task automation, it is easy to define fixed task sequences and run them repeatedly at the push of a button. When using motorised stages, multiple samples can be analysed automatically – and all in one step.

Cast iron analysis with automatic graphite detection

C Cast iron is evaluated either automatically or manually. Each graphite particle is automatically detected and evaluated with regard to shape and size. Sheets and diagrams show size and shape distribution results. Classifications according to various national and international standards such as VDG, EN ISO 945 or ASTM are integrated. Other norms can be added by users. In addition, determining the carbon-corrected ferrite/pearlite ratio is supported. All evaluatory criteria and analytical settings can be saved and adjusted for use with various preparation techniques.

A

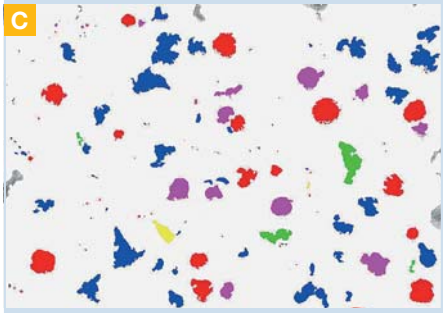


Grain-size analysis (intercept)

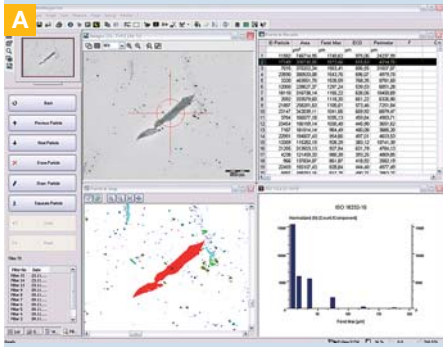
B

Planimetric grain-size analysis

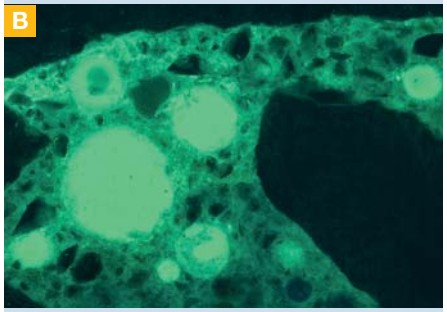
C



Nodular cast iron analysis



Residue analysis



Concrete analysis

Software for residue analysis

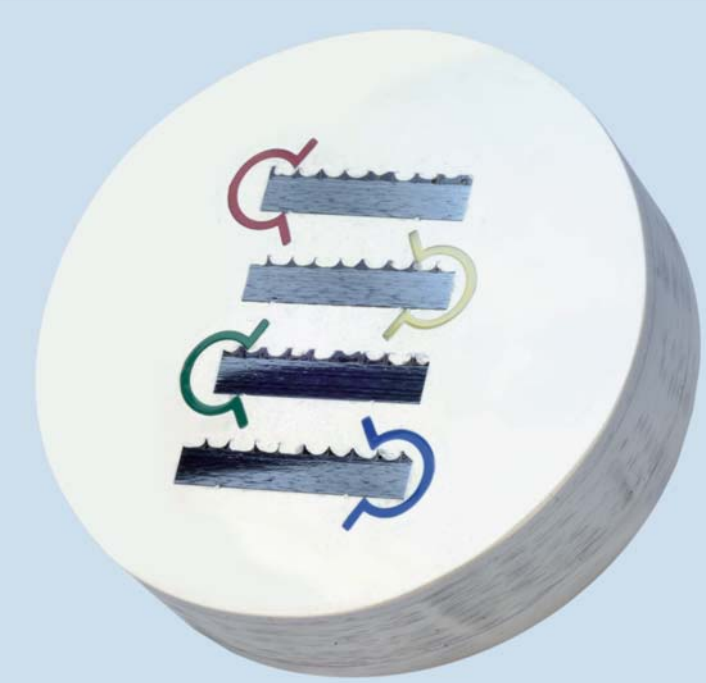
A Residue analysis enables users to assess and classify residue particles on circular filters. The system can be flexibly adapted to the respective application. The software operates the camera, microscope and motor stage. The automation options eliminate any possibility of user influence. Entire sequences can be defined and initiated at a mere click of the mouse. The results provided are particle and classification maps as well as particle data.

Quantification of air voids in concrete

B Analysing voids of air within concrete is compliant with the following norms: DIN 1048 and EN 480-11 via the size distribution (L300 content) and the average distance of these voids (distance factor). The concrete samples are positioned and evaluated fully automatically. The measurement takes place independently of the camera's field of view. Even voids that take up more than one field of view are measured completely – every time. The analytical algorithm is predefined and can be adapted to suit the specific sample conditions by the user. The results are classified precisely according to the standard selected and are then shown in standard-compliant sheets and reports.

C Embedded specimen

Carbon fibre compound material



Classification of non-metallic inclusions

Analysing non-metallic inclusions is no trouble, no matter how large the field of view. An inclusion that spans several fields of view will automatically be reconstructed as a single inclusion. Classification distinguishes between sulphidic and oxidic inclusions. Where the latter is concerned, oxides are further subdivided into dissolved, striped and spheroidal. Inclusions are classified in accordance with ASTM E45, DIN 50602 and JIS G-555. Additional standards may be created – such as other national or international standards or standards for use within your own company.

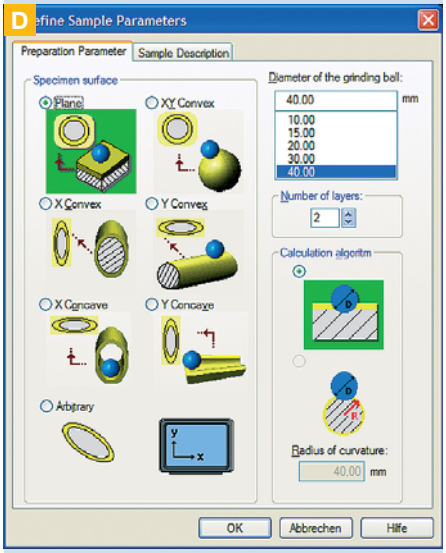
Particle analysis

Use the analytical functions to quantitatively detect and analyse thousands of image objects within seconds. Particle detection supports the analysis of multi-phase objects. For example, when porous material is being examined, both voids and grains can be inspected and classified simultaneously. It is easy to verify analytical results because respective measurement results are linked to the corresponding particles within the image.

Layer thickness measurement (calopreps)

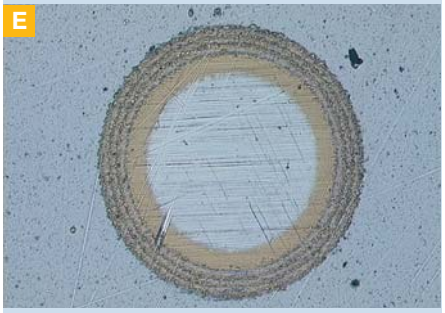
D **E** Calopreps is a standard method for determining the thickness of single and multilayer coatings. Analysing coatings not only determines layer thickness, but also provides more detailed information regarding adhesive strength and the slightest process failures. Results are displayed in sheets and graphically. Results may also appear in automatically generated reports.

D



Layer thickness measurement: parameters

E



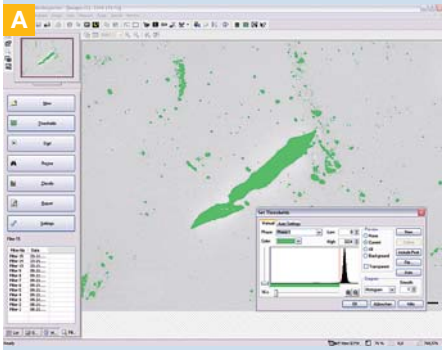
Ground-in sample

COMPREHENSIVE SYSTEMS FOR SPECIAL APPLICATIONS

Solutions ‘at the push of a button‘ – Simple efficiency

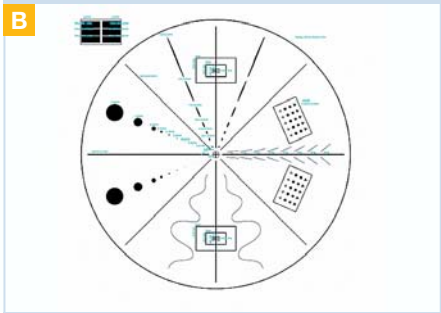
Each member of the analySIS Inspector series has been designed to solve a very specific task systematically and fully automatically. Software and hardware components such as the microscope, digital camera, motor stage and controller are so precisely that high exactitude and reproducibility are ensured regarding the measurements, analyses and evaluations conducted. All comprehensive systems have been specially developed and assembled to handle very specific applications. Nonetheless, they all subscribe to the same usage concept common to all products of the analySIS Inspector series. Once mastered, no further training is needed to use other members of the series.

A



Threshold setting

B



Particle standard for system validation

ANALYSIS FILTER INSPECTOR

Cleanliness is of particular significance in many industrial, pharmaceutical and medical applications. It can affect the lifespan and functionality of technical components. Virtually every production process and every product has specific requirements with regard to cleanliness. Here are some sample applications where filter analysis is used: determining contamination of lubricants, hydraulic fluids, fuels, carbon particulate in diesel emissions and when monitoring residues in engine blocks, transmissions, camshafts and crankshafts. These mandatory regulations for characterising contamination are defined in corresponding standards for the respective branches of industry. The amount of residue

High resolution – quick analysis

A analySIS Filter Inspector is a residue analysis system for fully automated optical analysis, classification and documentation of filter residues as well as for determining residue amounts on components or system parts. This comprehensive system, consisting of a microscope, motor stage with controller, digital camera and filter inspection software, was designed for fast analysis at high resolution.

Determining number and character of residue particles precisely

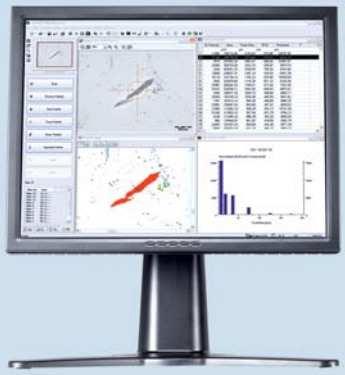
The analySIS Filter Inspector software is user-friendly and guides the user step by step through the entire analysis procedure. There is a minimum of steps involved and it's easy to learn to successfully conduct even more complex analyses. analySIS Filter Inspector precisely determines the number of residue particles on the entire filter. Images are acquired of the entire filter and the acquired images are analysed and classified automatically. The detection algorithm reduces possible user error and/or influence to a minimum.

The particle standard validation tool

B analySIS Filter Inspector offers particle standard, an integrated validation tool for checking calibration, particle parameter evaluation algorithms and sampling precision.

C **System solutions**

analySIS Fiter Inspector



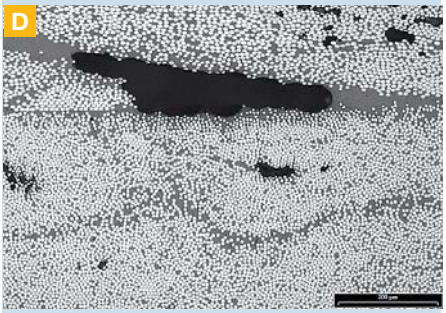
ANALYSIS PARTICLE INSPECTOR

D E Particle analysis means users can quantitatively record and analyse image objects. The applications for this kind of evaluation are numerous. One example is quality assurance for carbon fibre reinforced plastic materials. This requires particle analysis conducted within a fibre, resin and pore analysis context.

Rapid detection of particle parameters

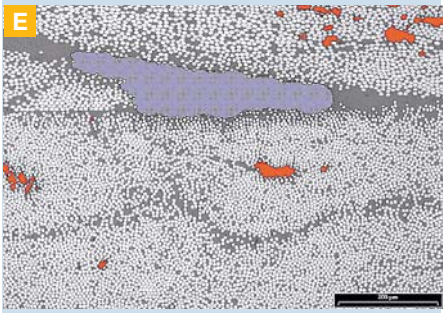
analySIS Particle Inspector is a comprehensive system for fully automated optical particle analysis, classification and documentation. This system consists of a microscope, digital camera, motor stage with controller and particle analysis software. Threshold-based evaluation of image particles offers particle detection, particle-specific measurements regarding particle parameters such as area, size, shape, location, density and intensity and also evaluations restricted to selected areas or object classes.

D

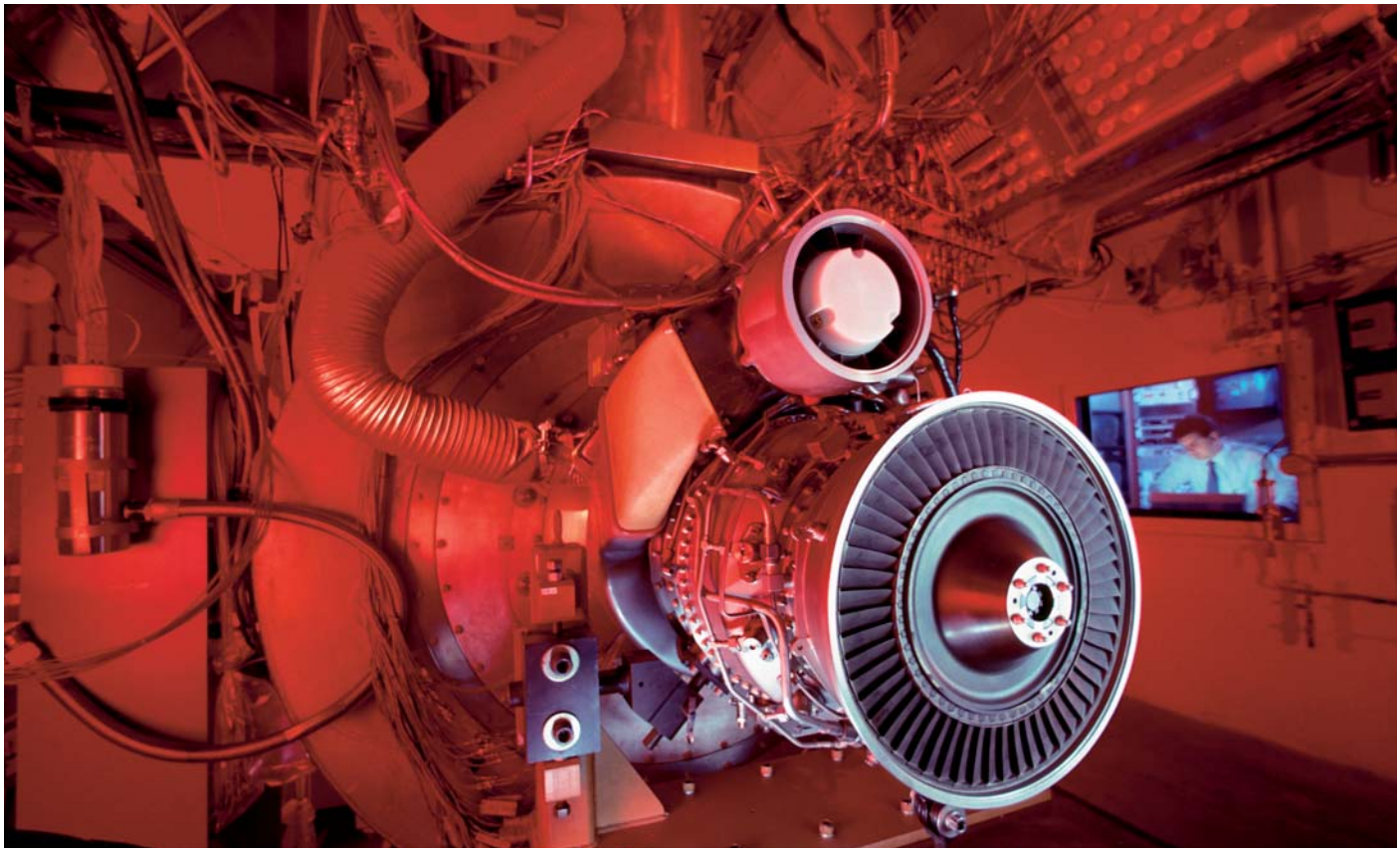


Detection in carbon fibre reinforced plastic

E



Classification by coulour coding



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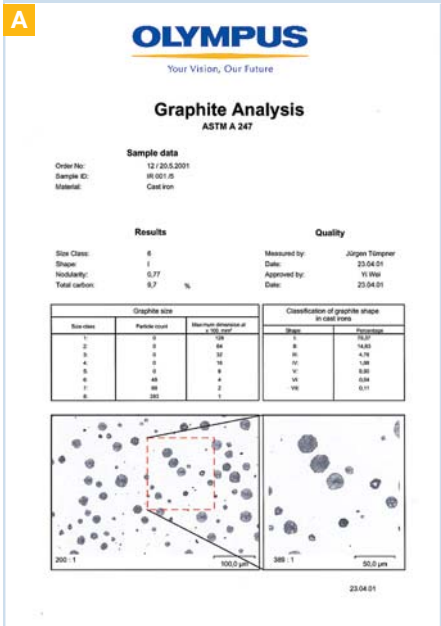


OLYMPUS

Your Vision, Our Future

Graphite Analysis

ASTM A 247

Sample data

Order No: 12 / 20.5.2001
Sample ID: IR 001.f5
Material: Cast iron

Results **Quality**

Size Class: 6 Measured by: Jürgen Tümpner
Shape: I Date: 23.04.01
Nodularity: 0,77 Approved by: Yi Wei
Total carbon: 9,7 % Date: 23.04.01

Graphite size			Classification of graphite shape in cast irons	
Size class	Particle count	Maximum dimension at x 100 mm²	Shape	Percentage
1	0	128	I	76,37
2	0	64	II	14,83
3	0	32	III	4,78
4	0	16	IV	1,99
5	0	8	V	0,90
6	48	4	VI	0,04
7	66	2	VII	0,11
8	281	1		

200 : 1 100,0 µm 500 : 1 50,0 µm

23.04.01

Analysis report conforming to standards

ANALYSIS CAST IRON INSPECTOR

A Properties such as tremendous hardness and ductility as well as low raw material costs, malleability and low shaping costs have made cast iron a commonly used material in the metal-processing industry. The quality and properties of cast iron are primarily determined by its graphite content. This is why it is so critical for product development and quality assurance purposes to evaluate the morphology and distribution of graphite within iron.

Analysis results at the push of a button

analySIS Cast Iron Inspector, consisting of a microscope, digital camera, motor stage with controller and evaluation software, is a comprehensive system for fully automated optical analysis, classification and documentation of the microstructure of graphite contained within cast iron. The entire acquisition, analysis and documentation process is conducted automatically at the push of a button. Each graphite particle is automatically detected and evaluated with regard to shape and size. The size and shape distribution results are displayed in sheets and graphically. Classifications according to national and international standards such as VDG, EN ISO, JIS and ASTM for assessing material quality are integrated. Other standards can be added by the user. All system configurations, evaluation criteria and analysis settings can be saved and adapted to various sample preparatory methods.

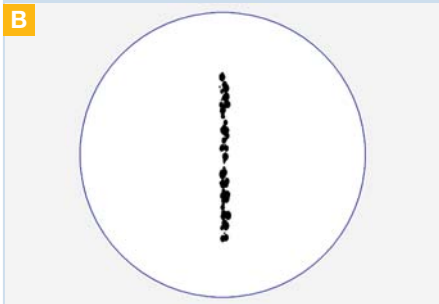
ANALYSIS INCLUSION INSPECTOR

B C Non-metallic inclusions in steel are the cause of dangerous and serious material defects such as brittleness and a wide variety of crack formations. Non-metallic inclusions are sulphidic or oxidic in composition and are due to the melting process. All steels contain non-metallic inclusions to a greater or lesser extent. The type and appearance of these non-metallic inclusions depends on factors such as the type of steel, melting process and the extent of shaping involved getting the ingot or casting strand into a finished product. It is particularly important to determine how pure the steel is. This provides information on the extent of sulphidic and oxidic non-metallic inclusions present.

Detecting inclusions no matter what the field of view

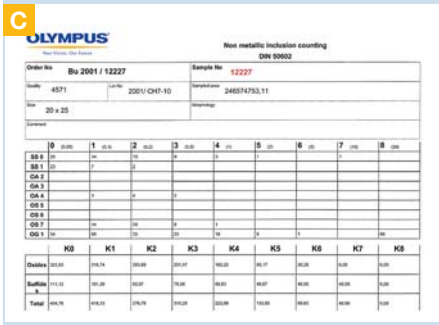
analySIS Inclusion Inspector, consisting of a microscope, digital camera, motor stage with controller and analysis software is a comprehensive system for analysis and documentation of non-metallic inclusion distribution. The analysis of non-metallic inclusions can be conducted no matter what size the field of view is. An inclusion that takes up multiple fields of view is automatically reconstructed as a single particle. Classification distinguishes between sulphidic and oxidic inclusions and the latter distinguishes between dissolved, striped and spheroidal oxides. Inclusion classification is compliant with ASTM E45, DIN 50602 and JIS G-0555. The range of standards available can be extended via classification sheets which may be edited. This means that other national and international standards as well as company-own standards can be realised.

B



Detection of non-metallic inclusion

C



Analysis report conforming to standards

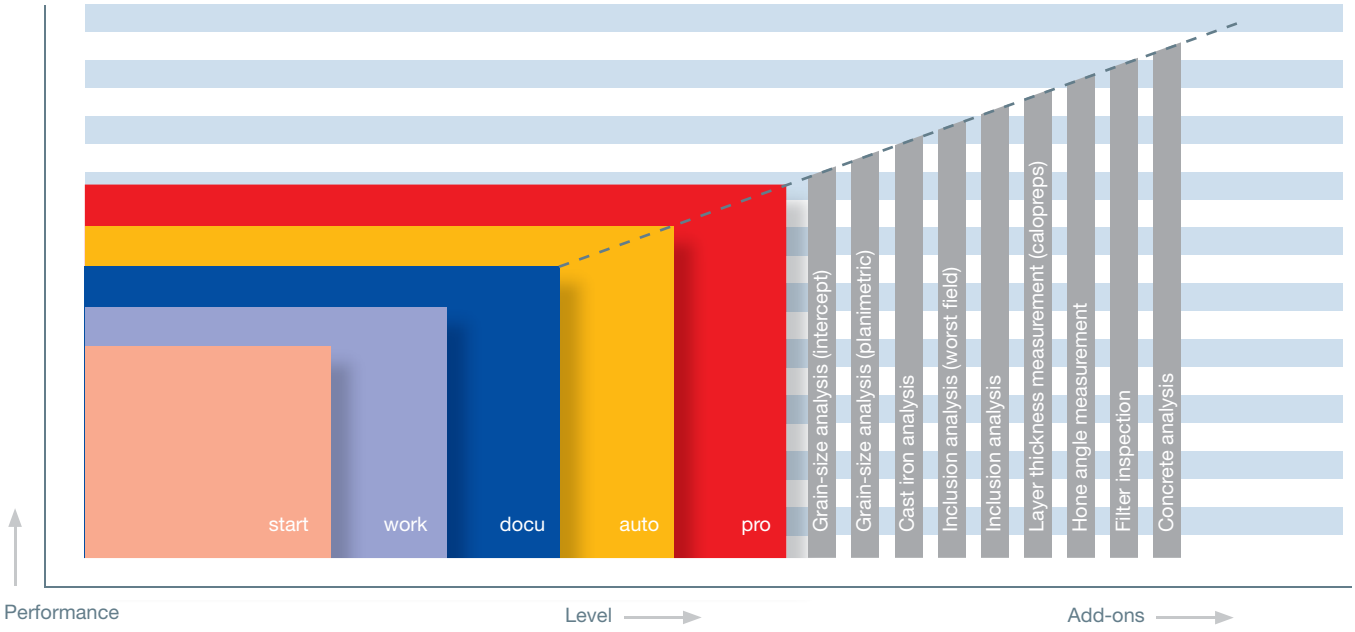
List of functions

		start	work	docu	auto	pro
Image acquisition						
Camera interfaces	FireWire IEE 1394 (specified I), USB2 (specified) frame grabber (specified), TWAIN	X	X	X	X	X
Image formats	*.tif, *.jpg, *.bmp, *.pcd, *.eps, *.png etc.	X	X	X	X	X
Image types	Binary 8-bit grey, 8-bit colour palette, 16-bit grey, true colour (24-bit RGB)	X	X	X	X	X
Movie recorder (AVI)	Makes movies of single acquisitions directly or from the live image	X	X	X	X	X
Extended acquisition						
Multiple image alignment	Panorama image function		X	X	X	X
Extended focal imaging	Infinite depth of focus			X	X	X
Remote control						
Olympus microscopes	IX, BX, GX, MX, SZX	X	X	X	X	X
Motorised stage	Autofocus with external Z-drives	X	X	X	X	X
	Stage navigator		X	X	X	X
	XY-scan for automation			X	X	X
Archiving and documentation						
Database	Structured image database		X	X	X	X
Reports	Report generator		X	X	X	X
Overlays	Use text, arrows, etc. for labelling (in live image, too)	X	X	X	X	X
Image processing						
Intensity	Maximise and equalise contrast; modify gray values, etc.	X	X	X	X	X
Changing bit depth	8/16 bit, colour 8/24 bit, binarise	X	X	X	X	X
Color modification	Colour spaces: RGB, HAS, colour separation, RGB Studio, etc.	X	X	X	X	X
Filters with preview function	Sharpen, edge enhance, mean, median, Sobel, Roberts, NxN,	X	X	X	X	X
	low pass, rank, differentiate x, differentiate y, connectivity, sigma	X	X	X	X	X
	DCE, shading correction; separator	X	X	X	X	X
Morphological filters	Erosion, dilation, open, close, top hat, skeleton, etc			XX	X	X
3-D display	3D-perspective, 3D-animation, height lines, texture			X	X	X
3-D processing	3D-measurements			XX	XX	XX
VoxelViewer/SliceViewer	Display and navigation through image stacks			X	X	X
Fast Fourier transformation	Fast Fourier transformation			XX	XX	X
Image pocket calculator	Addition, subtraction, multiplication, division, and, or, XOR, absolute amount			X	X	X
Selection						
Basic	Frame, mask	X	X	X	X	X
ROI	Polygon, rectangle, virtual ROI, etc.			XX	X	X
Data output						
Result	Sheets, statistics, diagrams, classification	X	X	X	X	X
Action	Processing and analysing diagrams			X	X	X
Interactive measurement						
Small	Count, distances (vertical, horizontal, arbitrary), intensity profile	X	X	X	X	X
Large	Angle, polygon, size, shape, etc., magic wand		X	X	X	X
Chain measurement	Creation of manual measurement procedures			X	X	X
Automatic measurement	Automatic measurement of any geometric shape via edge detection			XX	XX	X

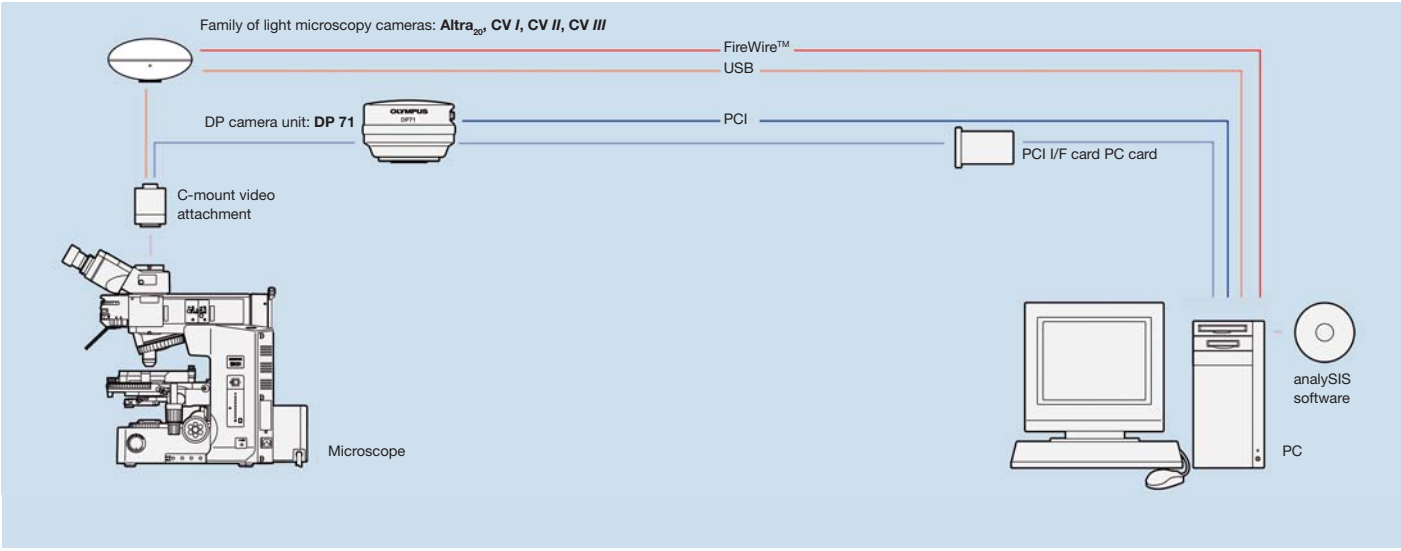
		start	work	docu	auto	pro
Analysis						
Phase analysis	Phase percentages, absolute areas			X	X	X
Particle detection	Number, position, size, shape			XX	X	X
Object tracking	Tracking objects through image sequences			XX	XX	X
Layer thickness measurement	Determining layer thickness using cross-sectional specimens			X	X	X
Microhardness testing	Microhardness testing (Vickers, Knoop)		X	X	X	X
Chart navigation	Chart comparisons using live image		X	X	X	X
Automation						
Automation	Automation of image acquisition, image processing, measurement, report generation, archiving			XX	X	X
Image sequence processing	Time-lapse acquisition of image sequences			XX	X	X
Programming						
Macro recorder	Scripts and playing back sequences		X	X	X	X
“Imaging C” programming	Environment for developing modules			XX	XX	X
Extensions						
Grain size analysis (intercept)	Intercept method for determination of grain size			XX	X	X
Grain size analysis (planimetric)	Planimetric method for determination of grain size			XX	XX	XX
Cast iron analysis	Cast iron analysis (graphite, ferrite, pearlite determination)			XX	XX	XX
Inclusion analysis (worst field)	Determination of purity of steel via “worst field” method			XX	XX	XX
Inclusion analysis	Full determination of degree of steel purity (ASTM E45, DIN 50602 ...)				XX	XX
Layer thickness measurement (calopreps)	Determining layer thickness using calopreps			XX	XX	XX
Hone angle measurement	Determining hone angle			XX	XX	XX
Filter inspection	Residue analysis			XX	XX	XX
Concrete analysis	Analysis of air voids within concrete				XX	XX

X included
XX optional

Specifications



System Diagram



The manufacturer reserves the right to make technical changes without prior notice.

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