

Living up to Life

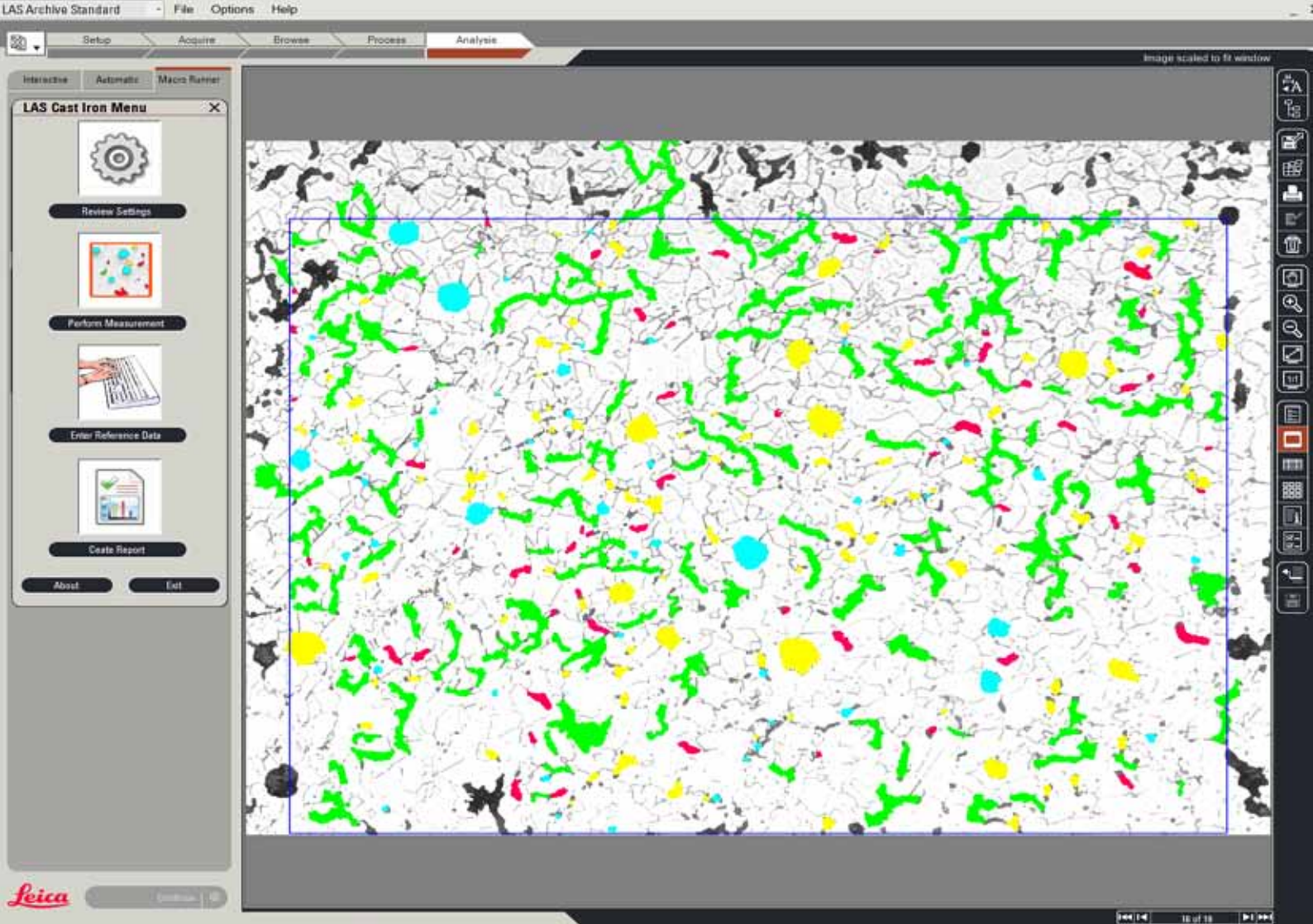
**Leica**  
MICROSYSTEMS

INDUSTRY DIVISION



# Leica Cast Iron Expert

Fast and Efficient Software for Cast Iron Analysis in Industry



## COMPREHENSIVE IMAGE ANALYSIS TECHNIQUES

Leica Cast Iron Expert offers the user a comprehensive solution for the microscope analysis of Cast Iron. The user can be confident that the analysis process conforms to their individual particular laboratory requirements. Leica Cast Iron Expert is used for ductile irons and incorporates industry standards including ASTM E247, ISO 945-2 and JIS5502.

The analysis identifies graphite nodules and places these into shape and size classes. Additionally, the Ferrite and Pearlite content of the sample may be optionally assessed. The results from these separate analyses can be combined to provide Ferrite and Pearlite results adjusted for the graphite content.

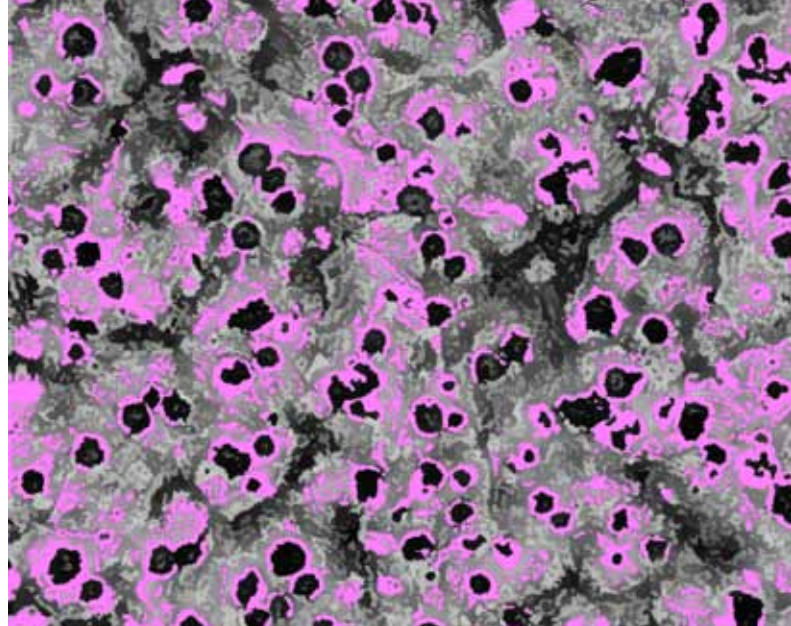
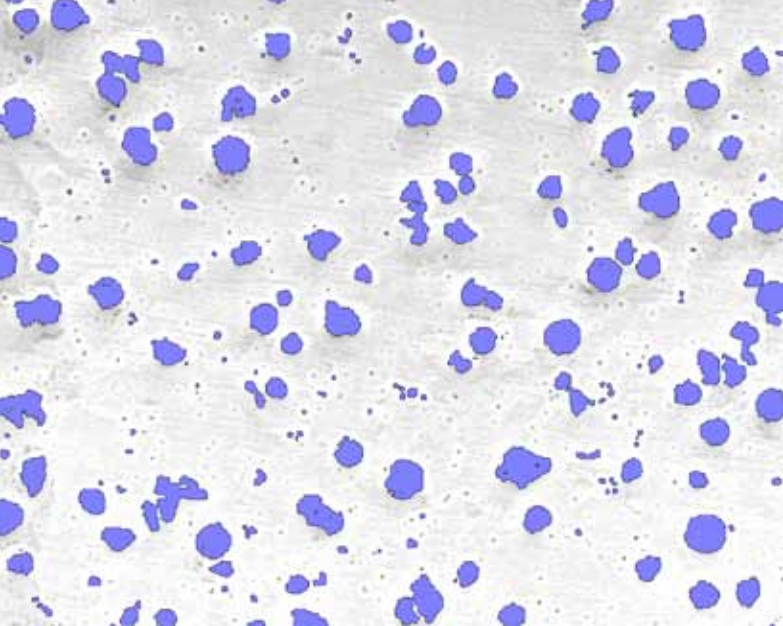
State of the art image processing is used to automatically enhance and accurately detect the graphite regions in the cast iron while the operator can always modify and confirm these. Results from the analysis may be used to qualify material to specifications determined between purchaser and manufacturer, for identification of variations in manufacturing processes, or to provide data for research studies of the structure and property of cast iron.

# Efficient Imaging Environment

Leica Cast Iron Expert evaluates high-quality images provided by the Leica Microscopy hardware. The Leica Application Suite (LAS) intelligently integrates the latest advances in automated microscopy, computing and digital image analysis. With a wide range of applications specifically designed for materials and metallurgy laboratories, it performs routine, yet sophisticated analytical tasks rapidly, efficiently, and economically.

This common micro-imaging environment is used to provide solutions for many industry standard and custom materials applications such as grain, steel inclusion, phase and cleanliness analysis. These applications integrate the understanding of specialists in the field into 'expert' applications dedicated to these tasks.

Leica Cast Iron Expert application software performs automatic, objective, and repeatable Cast Iron analysis simulating industry standards. This analysis is used in the evaluation of the properties of materials helping to determine the characteristics of a final product.



# Automatic, Smart, and Reliable

## AUTOMATICALLY IDENTIFY GRAPHITE AND FERRITE

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- › Monochrome images of the graphite and ferrite sample preparations are acquired using reflected brightfield microscopy
- › After edge-sharpening, the graphite is identified by a black threshold, its sensitivity can be interactively adjusted
- › Touching nodules of Spheroidal graphite can be automatically separated
- › Similarly, the ferrite is identified; in this case a white threshold is used
- › Spurious artefacts such as caused by polishing debris can be removed by use of image editing

## CLASSIFY GRAPHITE TYPES AND DERIVED RESULTS

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- › Measurements are made of the individual nodules by measuring many hundreds within a second
- › Graphite nodule types such as Vermicular, Irregular and Spheroidal are classified by multiple form factors
- › Tested values are provided and the user can fine-tune these if required
- › Graphite nodules are distributed into size classes based on the maximum diameter
- › For the Ferrite image, the Area Percent is immediately measured
- › Results are accumulated and averaged for the selected images
- › Adjustments are made to the Ferrite and Pearlite area values to remove the graphite contribution

## DOCUMENTATION OF RESULTS

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- › Measurements of individual graphite nodules can be
  - displayed in tables
  - shown as labels on the image
- › The graphite nodules can be coloured or labelled according to the individual class
- › A pie chart shows the percent occurrence of each class averaged over the specimen area measured
- › A histogram shows the percent area contributed by each size class
- › Measurement data and selected images are exported into a Microsoft® Excel™ template
- › The template can be customized to meet the local documentation standards
- › Data exported includes the reference data, all raw data as well as all Cast Iron measurement and field data
- › Once the settings for the analysis have been established they are saved so that that can be recalled and immediately applied in future

# More Benefits to save Time

LAS is designed to increase laboratory productivity and improve the accuracy of analysis by imitating and automating many of the manual processes required for materials analysis. As the analysis is objective, the results are inherently more reproducible.

## TOTALLY INTEGRATED SOLUTION

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With the combination of Leica microscopes, Leica digital cameras, image analysis expertise and system automation, you benefit from a truly integrated solution from one manufacturer.

## VERSATILE REPORTING

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Report templates can be configured to laboratory requirements using Microsoft® Excel™. Results are stored along with images, allowing all elements of the data to be recalled for detailed analysis. All your data is always available and traceable.

## STEP-BY-STEP OPERATION

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The application quickly guides the user through the necessary image processing and analysis steps, producing consistent, repeatable results with minimum effort. Once the workflow is defined, these settings can be recalled for repetitive tasks.

## COMFORT FOR THE OPERATOR

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LAS is simple to use due to its unified method of image acquisition, calibration and peripheral control. Image analysis reduces the tedium associated with manual measurements while providing improved statistical results.

## REPRODUCIBILITY

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Obtain reproducible results by automatically controlling imaging conditions with motorised microscopes and cameras in combination with predefined image processing settings.

## CONFIDENCE IN CONFORMITY

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Leica Microsystems' material application solutions comply with the widest range of appropriate standards available including ASTM, JIS, and ISO which gives users increased confidence in their results. Instrument Capability: Leica Cast Iron Expert software performs calculations that derive measurement parameters from digital images and follows procedures that comply with the standards mentioned.\*

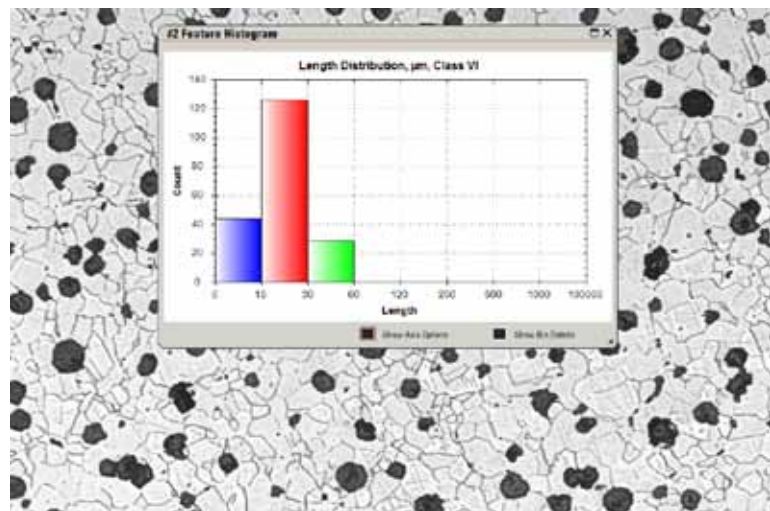
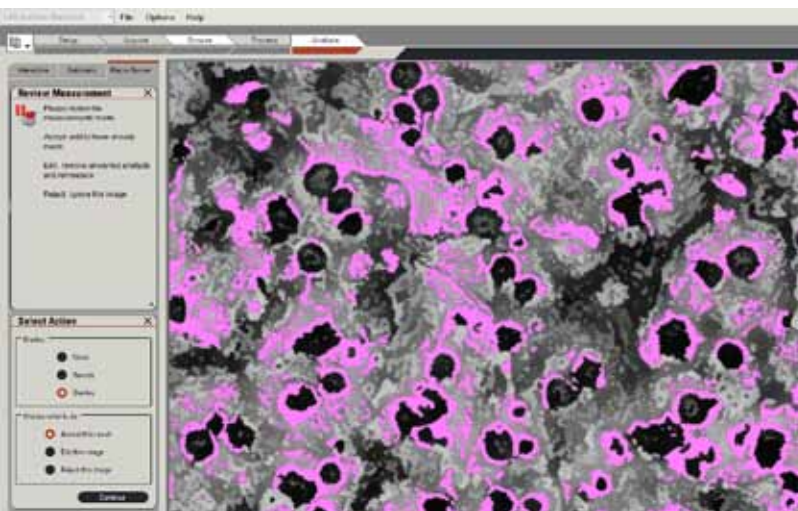
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\*The accuracy of the measurements and the compliance of the entire system to these standards strongly depends on a) the optical, electronic, and mechanical components used, b) the working conditions and sample preparation process, and c) the individual and specific interpretation of the results produced. These are the responsibility of the user of the equipment, and Leica Microsystems disclaims any liability in that context.

# Precise Image Acquisition

## Fast and reproducible

- › The first stage of Cast Iron analysis is to acquire a selection of digital images using LAS and to save these to the computer's hard drive. The advantage of this approach is that you always have the original images available to check your results later or to review the nodule classifications made directly on the image.
- › The ability of Leica Cast Iron Expert to give precise results assumes, that the sample chosen is a good representation of the specimen being analyzed and has been prepared in a manner that optimises the contrast of the graphite, ferrite and pearlite.
- › LAS acquires calibrated images by reading the magnification from the microscope and the sensor size from the camera to accurately determine the image dimensions.
- › The imaging conditions such as microscope settings and camera exposure are automatically recorded by the software. The data is stored with the image and can be used to monitor that consistent imaging conditions are used.
- › Images are named and acquired into a Windows® folder from where they can easily be located.
- › Images may be annotated with a calibrated scale bar, customized to your choice of style, and labelled with time, date, image name and description.
- › Optionally, images are captured at specified XY positions using a motorized stage to reduce bias in region selection.
- › Optionally, the microscope and camera settings can be recalled from an existing image ensuring the imaging conditions match previous settings.

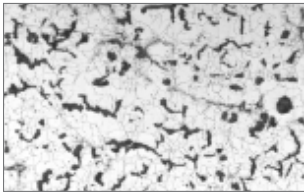


# Step by Step Operation

Convenient and reliable

## 1. SELECT GRAPHITE IMAGES TO MEASURE

Simply browse to the folder containing the graphite images to be measured and select them by clicking on the Thumbnail in the Gallery. The first of the selected images is displayed.



## 2. IDENTIFY GRAPHITE

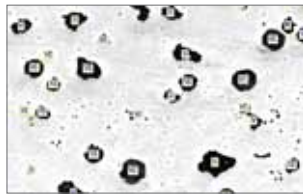
The graphite is identified by means of its black appearance and is shown as a coloured mask superimposed over the image. The contrast threshold used can be further refined to ensure that the mask precisely identifies the graphite. For nodular graphite, touching nodules are automatically separated.



## 3. MEASURE GRAPHITE

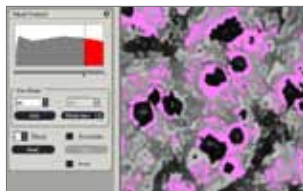
The size and shape parameters of the graphite are immediately measured and

placed into the size and shape classes. If the image includes spurious graphite due to preparation artefacts, Image Editing allows the operator to use the computer mouse to remove these. The operator accepts the measurements by checking the graphite classes that are displayed. The measurements are accumulated over a representative set of images.



## 4. MEASURE FERRITE AND PEARLITE

The selection, identification, and measurement steps are repeated for the Ferrite images. In this case, the Ferrite is identified by means of its white appearance. The percent content of Ferrite and Pearlite is measured immediately and the process repeated over a representative number of images with the data averaged.



## 5. RESULTS

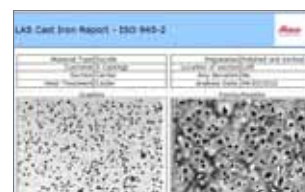
A summary of the results is displayed at each step of the process and detailed results can be shown as required. This comprehensive detail is invaluable when close study of the materials is required.

## 6. REFERENCE DATA

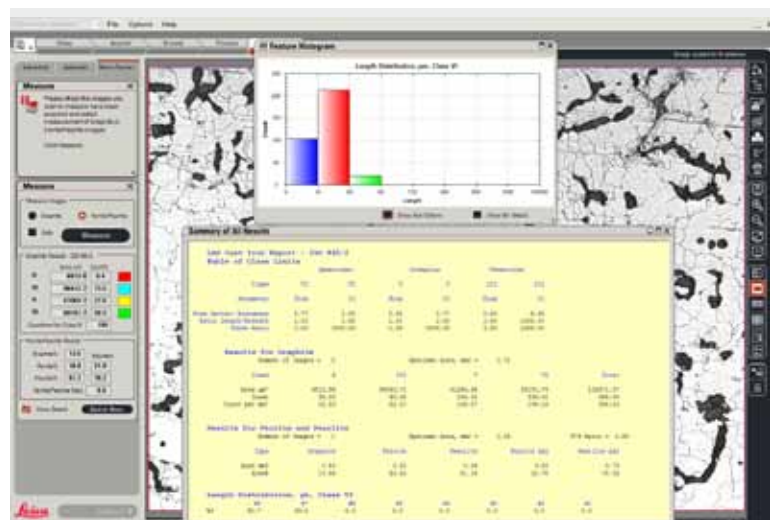
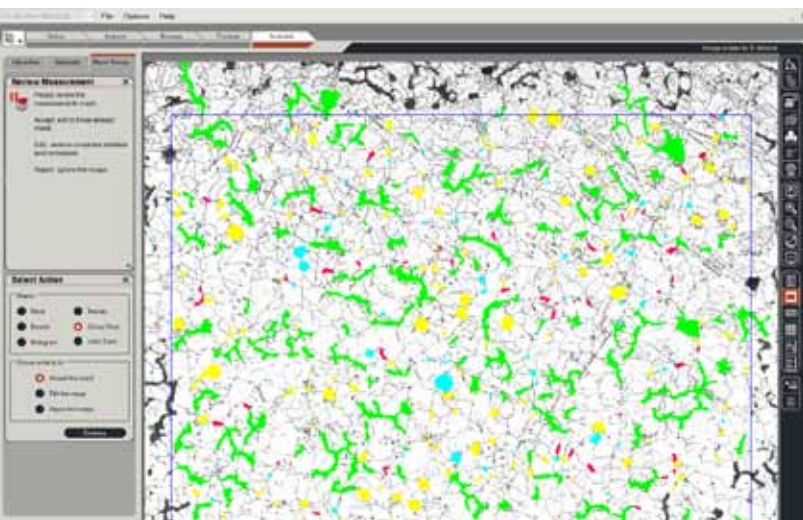
User and analysis reference information can be added and customised to make the results fully product and company specific. The data entered is automatically transferred to the report.

## 7. SELECT STANDARD AND REPORT

At this step the required standard is selected. The choice will depend on the local protocol of the laboratory. Reports are created using a Microsoft® Excel™ template supplied with Cast Iron Expert and this can be customised to fit into the needs of the organisation. In addition to the overview data shown on the report, the entire detailed analysis results are stored in the spreadsheet for further evaluation.









# Table of Cast Iron Parameters

## MEASUREMENTS FROM THE GRAPHITE IMAGES

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Total Specimen Area, mm <sup>2</sup>	The graphite image area
Graphite Area%	Area% for each class and unclassified remainder in a Pie-chart
Graphite Count%	Count% for each class and unclassified remainder
Graphite Count per mm <sup>2</sup>	Count per mm <sup>2</sup> for each class and unclassified remainder
Graphite Size Number	For Nodular Class showing percent of each size number in a histogram
Classification limits	Using Form factors of Roundness, Compactness, Area/Equivalent Circle Area Ratio Length/Breadth, Fibre Length/Breadth. Using pre-set default values or user-defined values.

## MEASUREMENTS ON FERRITE AND PEARLITE IMAGES

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Total Specimen Area, mm <sup>2</sup>	For the Ferrite/Pearlite images
Ferrite Area%	Area% of region identified as Ferrite
Ferrite Area, mm <sup>2</sup>	Calibrated Area of region identified as Ferrite
Pearlite Area%	Area% of region identified as Ferrite
Pearlite Area, mm <sup>2</sup>	Calibrated Area of region identified as Ferrite

## SOFTWARE ORDERING INFORMATION

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12 730 473	LAS Cast Iron Expert
12 730 218	LAS Image Analysis
12 730 074	LAS MultiStep
11 595 045	LAS Store & Recall

Microsoft® Excel™ is required for report generation

Optional complementary software

RELATED PRODUCTS



**LEICA DM2500 M**

The efficient Leica DM2500 M microscope for materials analysis and quality control.



**LEICA DMI 3000 M**

The Leica DMI3000 M inverted, manual microscope for materials science, industrial quality inspection and assurance, and new materials research and development.



**LEICA DM6000 M**

The universal microscope for all common incident light methods - brightfield, darkfield, polarization, interference contrast, fluorescence contrast.



**LEICA DFC450**

The Leica DFC450 microscope camera contains a high quality 5 Mpixel CCD sensor for sharp, brilliant images for documentation and analysis in life science, clinical and industry applications.

The statement by Ernst Leitz in 1907, “with the user, for the user,” describes the fruitful collaboration with end users and driving force of innovation at Leica Microsystems. We have developed five brand values to live up to this tradition: Pioneering, High-end Quality, Team Spirit, Dedication to Science, and Continuous Improvement. For us, living up to these values means: Living up to Life.

**INDUSTRY DIVISION**

The Leica Microsystems Industry Division’s focus is to support customers’ pursuit of the highest quality end result. Leica Microsystems provide the best and most innovative imaging systems to see, measure, and analyze the microstructures in routine and research industrial applications, materials science, quality control, forensic science investigation, and educational applications.

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