Automate your Microscope With CorrMeas!

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- CorrMeas is an addon program used together with the conventional Microscope operation software
- It can be used interactively for navigation tasks
- It automates the microscope as well as image analysis
- It provides correlative workflows and data storage

Supported Microscopes



Supported are

- All ZEISS Scanning Electron Microscopes
- ZEISS Axio Imager Vario (motorized stage required)
- Semilab AFMs with ScanTool
- Other third party microscopes on request





Two View Interface





Synchronized Two View Interface:

CorrMeas works with position lists, where each position can contain multiple images and additional information.



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- The images are drawn as recorded at the original position in the correct orientation in the graphical view
- Images from different microscope types can be overlayed, compared and used for navigation

The picture on the right shows small images inside large ones







- The Position Lists can be read in from a file, e.g. a coordinate file or a KLARF file
- Alternatively they can be created manually via the grid creation tool
- Or created by a script



Navigation

- The relationship between the microscope stage and the graphical view is created by defining two or more reference points (base coordinates)
- If three or more reference points are used, the software can do auto focus by plane fit, also when working interactively





Navigation



- After alignment, the stage can be navigated to a point on the sample just by a click
- The microscope image can be overlayed in real time to verify the position



Critical Dimension Measurements



For CD measurements, the following functionality is needed:

- Automatic Image Capturing, including precise position finding and auto focus (auto stigma for SEM)
- Automatic image evaluation, depending on the feature to be evaluated
- Automatic data storage

All functions are available in CorrMeas

Precise Position Finding



The stage precision is a limiting factor, this has to be overcome by position correction techniques. (Standard SEM stage accuracy ~ 3μm)

CorrMeas can use reference images or a GDS layout to perform automatic fine positioning



Automatic Image Acquisition



- CorrMeas can be "teached" by recording system states for imaging parameters and reference positioning
- The state system is completely flexible and can store basically any information.



• Setting up all imaging parameters manually and pressing "record" is enough

Automatic Image Acquisition



- The automatic image acquisition can be in many cases defined without writing any line of script code.
- Imaging recipes can be created automatically from the recorded imaging states.





via drag and drop without syntax errors.

Image Analysis



- Image analysis can be done directly while acquiring the images
- Alternatively, the image analysis process can be done on a computer which is not the microscope control PC
- There is no license required, if CorrMeas is copied to a different computer for image evaluation only and not controlling any microscope

The Filter Designer

- For image evaluation there is a different kind of script generator, the image filter designer
- This allows trying out different types of image filtering steps on stored images as well as on live images coming from the microscope
- If the selected filter sequence is appropriate, it can be converted into a recipe which can then be further refined





Example "Width Measurement"

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- We want to measure the height of the feature indicated in the image
- We have to use several filter steps to generate a stable result from this type of image (SE image), so that it works automatically with high reproducability



Filter Steps Needed





Original





Normalizer



Cropped



Average horizontally and measure distance between leftmost maximum and rightmost minimum

Evaluate Automatically

- The resulting script is used to automatically evaluate all the images and calculate a "Width" value, which is written next to each image in the table
- With the result one can sort after the width and find out where on the sample is the largest / smallest width
- The column on the right shows both Inlens and normal SE images, in the inlens image one can benefit of the bright borders but is more sensitive to charges



Line Edge Roughness

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- Another CD Application is Line Edge Roughness
- Small image on the right created by Gradient Filter, Lateral Filter and Normalization

Source Image





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Line Edge Roughness

- The Line Edge Roughness filter takes an extremum per line
- The lower diagram shows the variation of the extremum together with a line fit
- The difference between line fit and the positions is calculated as an RMS value which is put into the column "Width"
- The resulting script can then be used for all similar images







A GDS II layout file can be used for

- 1) Supporting interactive navigation
- 2) Automatic creation of reference images for precise positioning
- 3) Automatic creation of reference images for comparison

Automatic Reference Image Creation

- For precise positionig, reference images are required
- If there exists a GDS II layout file, references can be created on the fly at the target location, this removes necessity to record a reference image for every image type
- Creating references from GDS II layouts creates error free comparison images



Automatic Feature Comparison



GDS II layouts enable comparison of complex structures to its source layout, when e.g. normal distance measurements are not enough



Comparison Script Generation Tool



- The image comparison tool allows finding the distance of the next white pixels in two different images and return an average distance
- This allows automatic comparison of complex features



Defect Review













Data Exchange via KLARF files



Optional Extensions



Optional addons for full automatic operation available



The photo shows an extension for the ZEISS standard 80 mm airlock to allow motorized operation supporting automatic sample loading / unloading

