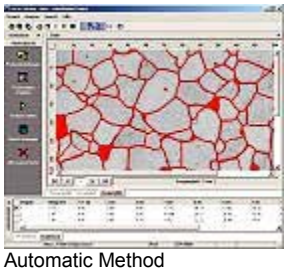
Digital Imaging

AxioVision Grains 4.1



Automatic Method
enlarge

- Tool to measure grain sizes
- ISO, EN, ASTM standards
- Three measurement methods:
  - Automatic
  - Interactive – intercept counting
  - Comparison method
- Supervisor / user mode
- Customized reporting

→ Let's Measure
→ Setting it up
→ Measurement Methods
→ Algorithms and Standards

pdf FAQ's
(approx. 260 KB)

→ Deutsche Version

Digital Imaging

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Let's Measure

For the routine day-to-day work, you can use the workflow:

Analysis settings: you can adjust setup your camera here, if you work online, or decide which files you need to analyze, if you use stored images

Sample description: at this point you can enter the relevant data about the sample analyzed, such as the account and the sample number, the sample description etc.

Run analysis: if you work with the microscope, you will now position the sample to the first field, focus it (you have a live window at your disposal for that) and press this button. Repeat this step for as many images as necessary.

Make report: once you have analyzed the desired number of fields or image files, you can generate the final report - here just
→ one example

Reset: you can restart the analysis if anything went wrong during the routine run.

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Setting it up

When setting up the measurement project, there are some questions that need to be answered before you can go ahead with a routine measurement: Which measurement method? What magnification? Where do images come from and which report template should be used? Once these questions have been answered, there's no need to ask them again! This is how it works:

 **User setup:** after loading the project, as defined and stored by the supervisor, the everyday users will not be bothered with unnecessary questions. They only need to set up the camera (for instance exposure time, brightness, focus) and select the standard to be used.

 **Supervisor setup:** users with the Supervisor privileges are allowed to create new projects and define a number of parameters and setup values that will stay fixed during the routine work.

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→ Measurement Methods
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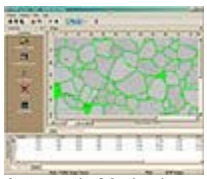
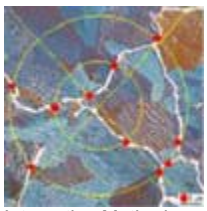
Measurement Methods



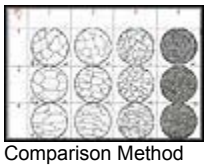
Automatic Method
enlarge

Automatic Method: if you work with ferritic and austenitic steels, ceramics etc (see Examples), you have a good chance that the automatic method can be applied. The result is not just the mean grain size, but also the distribution of grain sizes in your sample.



Interactive Method
enlarge

Interactive – intercept counting: in case of complex samples (martensitic or bainitic steels for instance) you can still obtain an accurate measurement of the average grain size using this method



Comparison Method
enlarge

Comparison method: a quick check of the average grain size using comparison tables. ASTM (I-IV), DIN, ISO tables available

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Algorithms and standards

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The methods of grain size analysis used follow the international standards.

The standards give the user a certain amount of freedom in selecting the method to be used. The possibilities range from the simplest, such as comparison method, through to the most complex methods, for instance grain boundary reconstruction and single grains evaluation.

The basic idea, however, is the same in all cases. The grain size is represented as a logarithmic scale of either number of grains per unit area, or their mean area or their mean linear size.

G	Grains/Area (#/mm^2)	Average area (µm^2)	Linear size (µm)
0	8.00	125000.00	320.00
1	16.00	62500.00	226.27
2	32.00	31250.00	160.00
3	64.00	15625.00	113.14
4	128.00	7812.50	80.00
5	256.00	3906.25	56.57
6	512.00	1953.13	40.00
7	1024.00	976.56	28.28
8	2048.00	488.28	20.00
9	4096.00	244.14	14.14
10	8192.00	122.07	10.00
11	16384.00	61.04	7.07
12	32768.00	30.52	5.00
13	65536.00	15.26	3.54

The same table is used in ↓bibliography references 3, 7 and 8

The **Auto** measurement method calculates the individual grain size on the basis of the surface of each individual grain, and, from this, the distribution. The corresponding grain size is then calculated on the basis of the following formula:

grain size = - $\log_2$ (grain surface in µm^2 / 125000.0)

With the **Chord** measurement method the average chord length is calculated, in accordance with the standard (e.g. bibliography reference 1), on the basis of the points of intersection defined by the user:

grain size = - 2 $\log_2$ (average chord length in µm / 320.0)

There is a small, insignificant difference if the ASTM standard is used: the number of grains per area for G=0 is defined as 7.75. This leads to a constant difference of 0.0458 in the grain size, which is negligible, when compared with the usual spread of grain sizes.

Reference Standards

1. ISO 643 (September, 1983): Steels - Micrographic determination of the ferritic or austhenitic grain size

2. ASTM E 112 74: Standard Methods for ESTIMATING THE AVERAGE GRAIN SIZE OF METALS

3. EURONORM 103 - 71 (November, 1971): Mikroskopische Ermittlung der Ferrit- und Austhenitkorngröße von Stählen

4. DIN 50 601 (August, 1985): Ermittlung der Ferrit- und Austhenit-korngröße von Stahl und Eisenwerkstoffen

5. SEP 1510 - 61: Mikroskopische Prüfung von Stählen auf Korngröße mit Bildreihen

6. ASTM E 1382 -91: Standard Test Methods for Determining Average Grain Size Using Semi-automatic and Automatic Image Analysis

7. JIS G 0551: Methods of Ferrite Grain Size Test for Steel

8. JIS G 0552: Methods of Austhenite Grain Size Test for Steel

AxioVision Materials

Frequently asked questions

AxioVision Materials FAQ questions answers

Summary

This document is an (ever-expanding) information of AxioVision Materials application - Grains kit. Please feel free to ask unanswered questions via e-Mail to CZV_support@zeiss.de

Index

Introduction

The entries into the FAQ are ordered on the last-entries-first basis. Additionally they are sorted according to the application (Grains, Graphite, Multiphase) and eventually (but not yet) according to the version.

General

General 1- Project home directory is not simple to find

The projects are stored in the work-group's documents and settings subdirectory:

```
Documents and settings\all users\documents\Carl Zeiss\Data\MATProjects.
```

This is certainly a mouthful to swallow – but it is 100% Windows-conform… Make yourself a shortcut to the said subdirectory on the desktop or add it to your favorites, if you feel you will need it more often.

Note that you do not *need* to store projects in the offered default subdirectory. You can put them anywhere – for instance in „ Z:/MyProjects". And if you use a certain project often, you will have it in the list of Most Recently Used files anyhow.

Note that in a case of a multi-user system, every user has his or her own home subdirectory, where the data, if wished so, will get stored.

General 2 - User – Where are my data

Where does the Materials application store the data (both in CSV and XML format)?

The data are stored in a subdirectory whose name consists of the name of the project used and the sample analyzed. Let's assume you use project 0815BB, the order number is XY12 and the sample number is 0003 (the last two you entered in the sample description at the beginning of the analysis). The data will then be stored in the subdirectory 0815BB_XY12_0003. Where the said subdirectory is to be found, depends on which application is generating it: you would find it in:

.\MatDocuments\AxioVision Grains - for Grains
\MatDocuments\AxioVision Graphite - for Graphite
\MatDocuments\AxioVision Multiphase – for Multiphase.

As ever, nothing beats a well-placed shortcut (in favorites or on the desktop).

Note that in both cases (CSV and XML) the file stored is called export. Every export file has trhe same name – the context of data exported is given by the name of the subdirectory, where this file is found (and, of course, by the contents of the file)

General 3 - I need access to data

Use XML or CSV option in the setup. Note that data available correspond to the information, that is provided in the reports –there's no information about individual measurements

General 4 - AxioVision users - you need a separate set of scalings for Materials

The two sets are separated (version 03-2003) , but you can freely copy among them. The Materials scaling files are to be found in

```
Documents and settings\all users\documents\Carl Zeiss\Data\Scaling
```

General 5 - How do I do several images

When analyzing stored images, you will be presented the directory of target files. Chose the next one, and press continue. If you work with the camera, just move the sample to a new position and press Icon Run Analysis – or the key F5.

General 6 - Demo projects? Where are they?

You can find them in the Help submenu (Load demo projects). The shortcut is Ctrl+Shift+O.

General 7 - I cant properly store changed demo projects

You can not change and properly store demo projects. They are meant as for-the-show-only. On the other hand, it should not be too difficult to reenact what they are doing.

General 8 - How can I eliminate an unwanted scaling?

Delete the corresponding *.zvsc file. The Materials scalings can be found in the subdirectory that's in the same parent as MatProjects –

```
Documents and settings\all users\documents\Carl Zeiss\Data\Scaling
```

General 9 - How can I repeat old measurements?

Make first sure that you store the images taken – in the supervisor mode check the checkbox store as XML file. Then you can read the images from the disk

General 10 - which cameras are supported?

Every member of the AxioCAM family and all the cameras that use Meteor frame grabber. In other words, any camera supported by AxioVision, is also supported by Materials Kits.

General 11 - The image taken by the camera is dark, although live image is OK

Delete all default.ini files, that pertain to your camera.

General 12 - The image taken by the camera is OK, but my live image is overexposed

Same thing: delete all default.ini files, that pertain to your camera.

General 13 - How do I adjust the live image speed?

In the 03-2003 Version you need to do the following: look up the file default.ini for your application. Find first the Carl Zeiss/Profiles subdirectory

```
Documents and setting/<user id>/Application data/Carl Zeiss/Profiles/
```

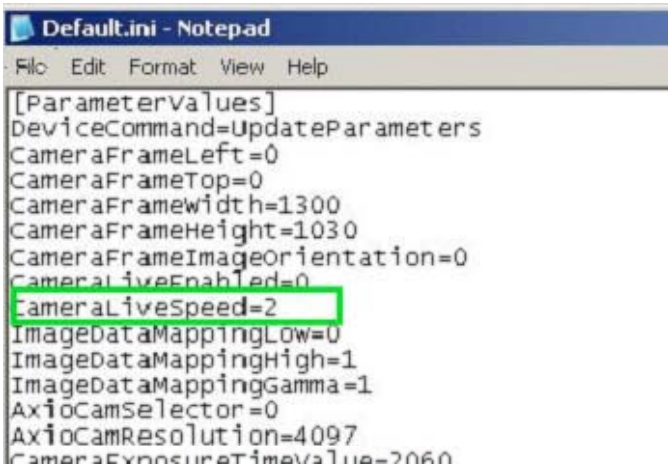
Then within this subdirectory look further to:

```
…/<Application>/Default/<camera name>
```

Were your ID ***JoeDoe,*** were you looking for ***AxioCAM HR***, and were you using ***Grains***, then the name would be:

```
…/JoeDoe/Application data/Carl Zeiss/Profiles/AMATgrains/Default/AxioCamHR
```

Double-click on the file default.ini to edit it:



The entry ***CameraLiveSpeed*** indicated above, is set per default to 2, ie to fast speed. Change it to 0 – for slow or to 1 – for medium.

If you have several application kits on your system, then you will need to do that for every one of them.

General 14 - Factory defaults do not look OK

By pressing the factory default icon (last icon in the icon bar) you may get an empty space between the workarea and the images window. Check the display resolution: it must be bigger than 1024x768, which is the assumption we made, when we defined the factory defaults.

General 15 – Materials don't work on my country's version of Windows

There's two language version of Materials kits available, German and English. State explicitly the language you prefer. The following line will run the English version of grains, whatever the country version of Windows:

"C:\Programs\Carl Zeiss Vision\AxioVision Grains\AMatGrains.exe" **-LCID=9**

Corresponding code for Germany is 7 – example with Multiphase:

"C:\Programs\Carl Zeiss Vision\AxioVision Multiphase\AMatMultiphase.exe" **-LCID=7**

Grains

Grains - 1 Are the grains on edges (auto procedure) included in the analysis?

Yes, the grains on the edges are included in the measurement.

Grains - 2 Can I edit misplaced grain boundaries or insert missing ones (auto) ?

No, this is intentionally not possible. Use intercept method, if this is a critical issue. Note however, that you will get much less (interactive, just the average grain size) and much slower than with the auto method (automatic, distribution of grain sizes), even if there's some artifacts in the final processed image.

MultiPhase

Mul - 1 – How should I set up the statistics

There's three parameters available to set up the statistical analysis - distributions etc:

- Minimum value of the parameter measured
- Maximum value of the parameter measured
- Log vs Linear classification

It is assumed you would have some idea about the sizes of particles analyzed - of course you will have to think in um2, when you use area as the parameter measured, and in um for instance, when you measure maximum diameter. The best method, when setting up the project as the supervisor, is to start with 0 as minimum and a big enough maximum, so that you will get some numbers in the reports, when you test with real samples. Adjust then the maximum to suit your expectations.

Note that in case of a log scaling you would rather begin with 1 for minimum (for instance) and some round number (1000 for instance) for the maximum.

The number of classes is fixed throughout to 8 (plus overflow and underflow classes). To have round class boundaries for instance, choose minimum and maximum accordingly, for instance 0 for minimum and 240 (=8 * 30) for maximum for the linear case or 10 to 2560 (=10 * 2^8) in log case.