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# DEEP DIVE INTO A FASTER GRINDING AND POLISHING PROCESS WITH LESS WASTE

Competitor benchmark, test, data and proofs



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# REPRODUCIBLE RESULTS – FASTER AND WITH LESS WASTE

Struers' combination of MD grinding surfaces, DiaPro All-in-One suspension, and MD polishing cloths delivers a high-efficiency process across materials and preparation requirements. With high and consistent removal, your methods stay robust and time-efficient – while easy cleaning and minimal rework help reduce waste.

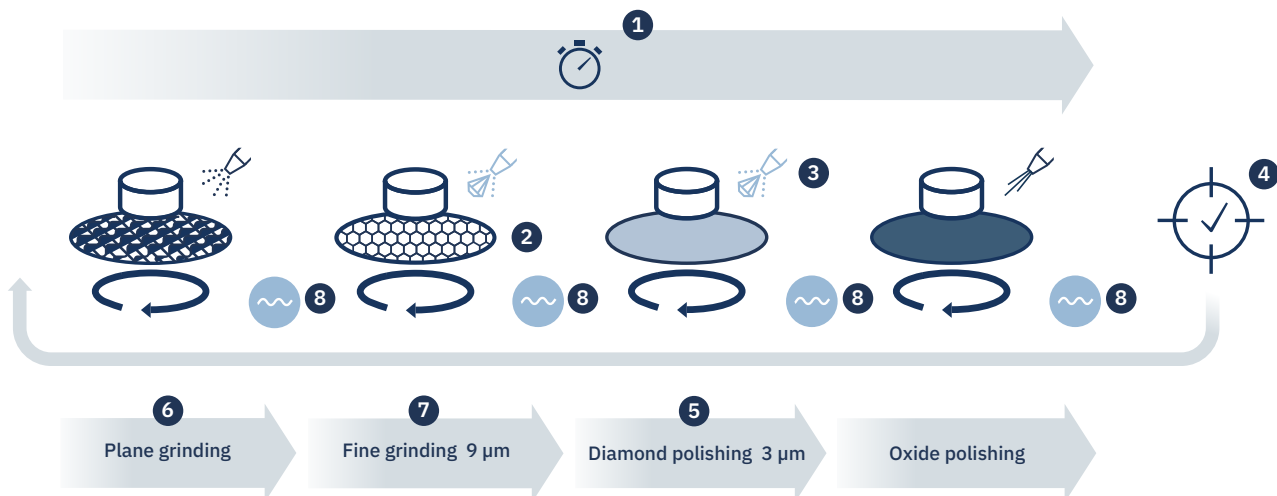
This guide shows how to refine your grinding and polishing workflow to speed up preparation and lower consumable use per specimen. In many cases, Struers' consumables have been tested against other products \* – and the results speak for themselves.

\* Struers performed in-house testing of Struers products and similar products from three other manufacturers on different materials: aluminum alloy, induction hardened steel, and stainless steel. All tests were performed on 30 mm dia. specimens. The specimens were plane grinded before starting. A series of more than 10 preparations was run on each material and consumables from each manufacturer, using the manufacturer's recommended settings. The removal rate and dosage presented are an average from more than 10 preparations (excluding errors). Examples of these tests will be shown in this document.



## 8 ways to a faster process with less waste

We have identified 8 areas where you can optimize your process. Use this illustration to find out where you can improve your process. The guide to each area can be found on the following pages.



|                                                                                |           |
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## 1 Removal



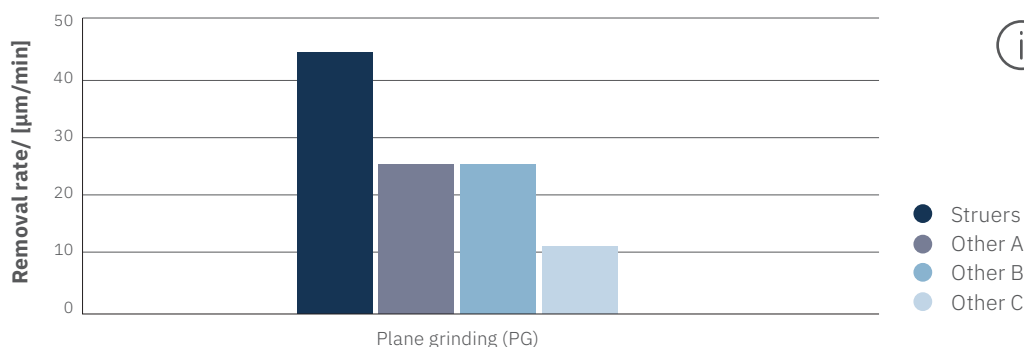
# SAVE TIME WITH MORE REMOVAL

Many factors play a role in the length of your preparation. The removal rate is particularly important to a short method, so you need consumables that deliver high removal. But you also need consumables with a constant removal rate (e.g. low standard deviation) to ensure a robust method. Your suspension must also distribute thoroughly across the polishing cloth, as this reduces cloth run-in time and process time. Combined, all these things give you more removal, enabling you to shorten your preparation method significantly.

## 50% shorter preparation steps with high removal

Removal of material is done in each step of the materialographic grinding and polishing process. This means that constant and high removal rates are key for a fast and efficient preparation process.

### 50% higher removal translate into 50% shorter preparation time

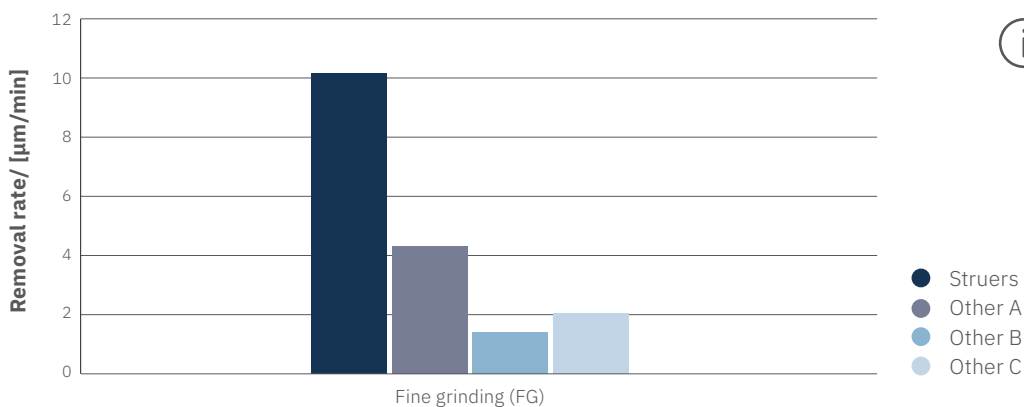


**Up to 50% faster plane grinding of surface hardened steel with Struers' MD-Piano.**

Ensuring planeness in the 9 µm step is essential for a high-quality preparation result. But could you shorten your 9 µm step by 50% and still get plane specimens? You can when using Struers' MD-Allegro\* and the dedicated 9 µm DiaPro suspension.

\* Expect same amount of process optimization when using MD-Largo on softer materials and composites

#### More than 50% higher removal enables equally shorter fine grinding step



**More than 50% faster 9 µm step, when preparing surface hardened steel with Struers' MD-Allegro & DiaPro Allegro/Largo 9µm suspension.**

## High removal must never compromise the end result

The final preparation result from the comparison study shows a high-quality. A fast plane grinding and 9 µm step must never compromise the end result.



**Inclusions are retained and fully polished, without scratches.**

Final preparation result MD Nap (x 200) Hardened steel.

## 1 Removal

### No need to prolong a step due to process deviation

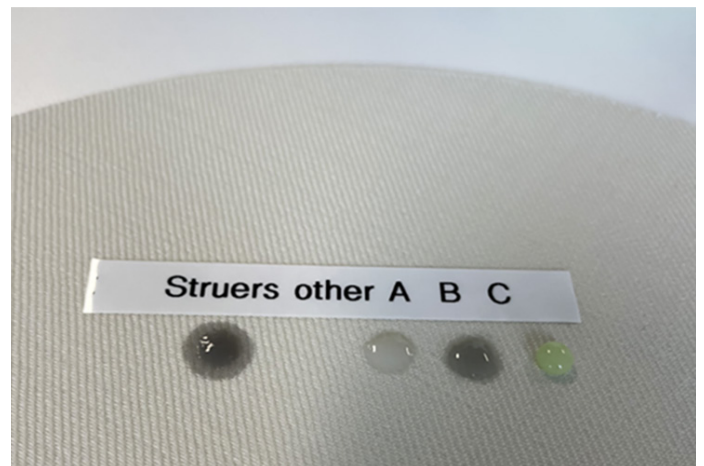
As well as high removal, a constant removal rate is important for your process step if you want to save time. Why? Because constant removal enables a highly robust preparation step. As a result, there is no need to add additional time to the preparation step to account for possible variance in the removal rate.

|                | Plane Grinding (PG)      |                         | Fine grinding (FG)       |                         | Fine Polishing (FP)      |                         |
|----------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                | Removal rate<br>[µm/min] | Standard<br>deviation % | Removal rate<br>[µm/min] | Standard<br>deviation % | Removal rate<br>[µm/min] | Standard<br>deviation % |
| <b>Struers</b> | 44.8                     | 3                       | 10.1                     | 9                       | 1.3                      | 19                      |
| <b>Other A</b> | 25.6                     | 11                      | 4.3                      | 23                      | 2.3                      | 15                      |
| <b>Other B</b> | 25.6                     | 11                      | 1.3                      | 15                      | 0.3                      | 51                      |
| <b>Other C</b> | 11.8                     | 9                       | 1.9                      | 17                      | 1.0                      | 19                      |

A low standard deviation allows for a highly robust step and can be translated into a shorter preparation time. As seen in the chart, the Struers' standard deviation on the removal is lower than other products in the industry. This goes for both the plane grinding step and the 9 µm step.

### Suspension works instantly when dosed – no wasted time

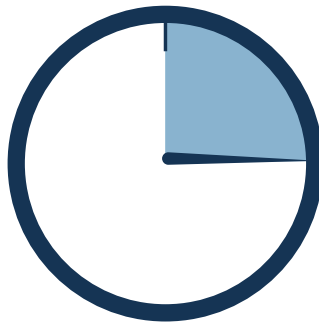
How can the wetting properties of a suspension onto the cloth optimize your process? The answer is simple. The fast, thorough and evenly distributed abrasives onto the polishing cloth helps ensure the efficient removal of material from the specimen, for a high quality and robust result. As well as reducing the run-in time of new polishing cloths, this leads to lower consumable consumption throughout the polishing step as the abrasives and lubrication are distributed quickly during the process.



**Wetting properties are very important for a good preparation.**



Struers' cloths



Other products

**Run-in time.**

When using traditional diamond products, the cloths usually need up to 15 minutes run-in time, but with DiaPro suspensions, polishing cloths run-in time is practically eliminated.



## 2 Step reduction



# FEWER STEPS TO A HIGH-QUALITY RESULT

Reducing the number of steps in your method is only possible if there is high compatibility between the result of step 1 and the performance of the next step. This compatibility is ensured with Struers' consumables, as we take a total process approach when developing products.

With Struers' consumables, no excessive deformation is made to the material that would require additional time in the next step. They also enable you to reduce the number of steps to a minimum, while retaining optimal quality, so you get the shortest possible path to your result.

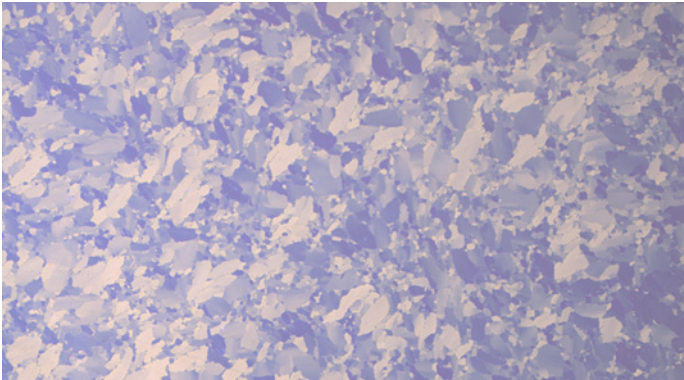
Here are two examples of how you can go directly from your 9 µm step to oxide polishing – to reduce your number of preparation steps with up to 50%.

## Reduce your number of preparation steps with up to 50%

### Titanium grade 5 – two steps eliminated

| Conventional method                                                                 | Grinding                                                                                 |                                                                                        |                                                                                        |                                                                                        |                                                                                         |           | Polishing    |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------|--------------|
|                                                                                     | STEP  | PG  | PG  | FG  | FG  |           |              |
|                                                                                     |       | Surface                                                                                | SiC #220                                                                               | SIC #500                                                                               | SiC #1200                                                                               | SiC #2000 | MD-Chem      |
|                                                                                     |       | Suspension/<br>Lubricant                                                               | Water                                                                                  | Water                                                                                  | Water                                                                                   | Water     | OP-S 0.25 µm |
|  | Time (min)                                                                               | 1                                                                                      | 1                                                                                      | 1                                                                                      | 1                                                                                       | 5         |              |

| Optimized method |            |                          | Grinding |                               | Polishing    |
|------------------|------------|--------------------------|----------|-------------------------------|--------------|
|                  | STEP       |                          | PG       | FG                            | OP           |
|                  |            |                          |          |                               |              |
|                  |            | Surface                  | MD-Mezzo | MD-Largo                      | MD-Chem      |
|                  |            | Suspension/<br>Lubricant | Water    | DiaPro Allegro/<br>Largo 9 μm | OP-S 0.25 μm |
|                  | Time (min) | 1                        | 4        | 5                             |              |



Final preparation after Oxide Polishing on MD-Chem (x 200)

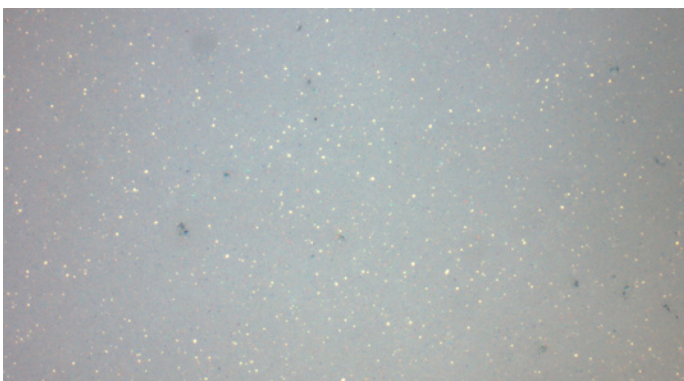


Titanium is often run with several SiC paper/foil steps. With a Struers' standard method using MD-Mezzo for the plane grinding step, it is possible to go from the 9µm step directly to oxide polishing, reducing the method to only 3 steps.

## Silicon Nitride – three steps eliminated

|                     |                                                                                                              | Grinding                                                                               |                                                                                        |                                                                                       |                                                                                        | Polishing                                                                               |                                                                                         |
|---------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Conventional method | STEP                      | PG  | PG  | FG  | FG  | DP  | OP  |
|                     |  Surface                  | MD-Piano 220                                                                           | MD-Piano 1200                                                                          | MD-Allegro                                                                            | MD-Largo                                                                               | MD-Dac                                                                                  | MD-Chem                                                                                 |
|                     |  Suspension/<br>Lubricant | Water                                                                                  | Water                                                                                  | DiaPro Allegro/<br>Largo 9 μm                                                         | DiaPro Largo<br>3 μm                                                                   | DiaPro Dac<br>3 μm                                                                      | OP-S 0.25 μm                                                                            |
|                     |  Time (min)               | 3                                                                                      | 3                                                                                      | 6                                                                                     | 6                                                                                      | 4                                                                                       | 1                                                                                       |

|                  |                                                                                                                      | Grinding                                                                               | Polishing                                                                              |                                                                                        |
|------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Optimized method | STEP                              | PG  | DP  | OP  |
|                  |  <b>Surface</b>                   | MD-Piano 220                                                                           | MD-Plan                                                                                | MD-Chem                                                                                |
|                  |  <b>Suspension/<br/>Lubricant</b> | Water                                                                                  | DiaPro Plan 9 µm                                                                       | OP-S 0.25 µm                                                                           |
|                  |  <b>Time (min)</b>                | 2                                                                                      | 10                                                                                     | 1                                                                                      |



Final preparation after Oxide Polishing on MD-Chem (x 200)



Preparation of ceramics is most often done with several steps. Sometimes up to 6 steps in total. With Struers' consumables, you can reduce this to just 3 steps, giving you a 50% step reduction.

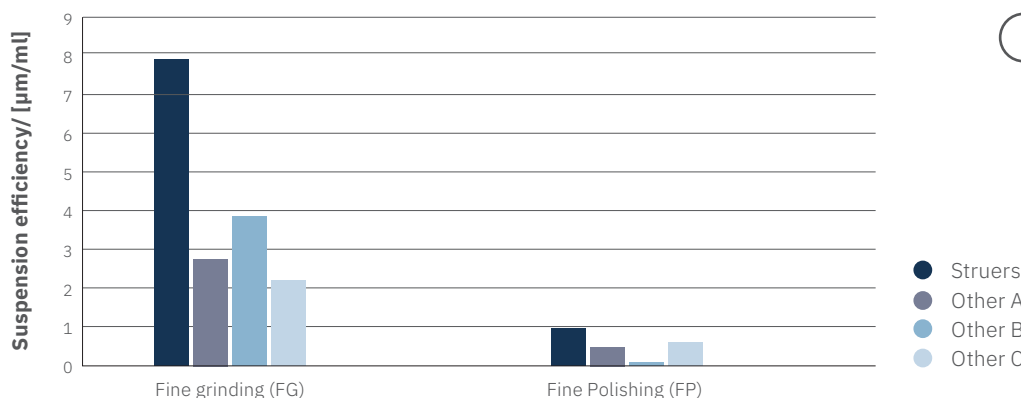
### 3 Lower dosing



## A LITTLE DROP WITH HIGH IMPACT

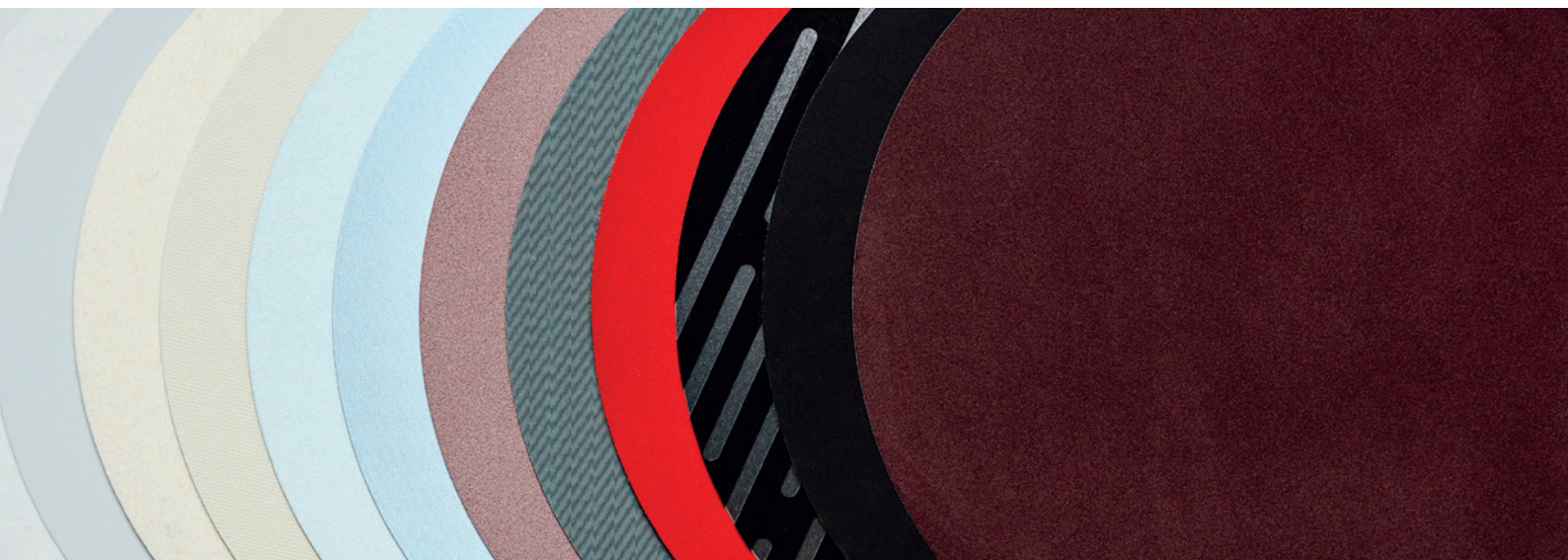
The efficiency of your suspension (i.e. the material removal per  $\mu\text{m}/\text{ml}$ ) has a direct impact on your consumable consumption. Struers' DiaPro All-in-One suspension is optimized to the relevant polishing surface. This ensures the abrasives are optimally distributed, for the highest suspension efficiency and performance. In addition, Struers' suspensions always have an equal distribution of abrasives throughout the bottle, so you never need to shake the bottle or use magnetic stirring again.

### High suspension efficiency reduce consumption with at least 50%



Compared to other products, Struers' DiaPro All-in-One suspension removes significantly more material. We call this Suspension efficiency.

Struers' DiaPro All-in-One suspensions have superior efficiency – so, you remove more material with the same amount of suspension. By this you can shorten your preparation time and herewith the consumable consumption. This makes the process both faster and more cost-efficient.



## Quality is not compromised

Struers' consumables achieve a high-quality optimal result – also with lower dosing levels.



**Austenitic stainless steel with  
well-defined grain boundaries and  
retained inclusions**

Final result in DIC after oxide polishing (x 200).

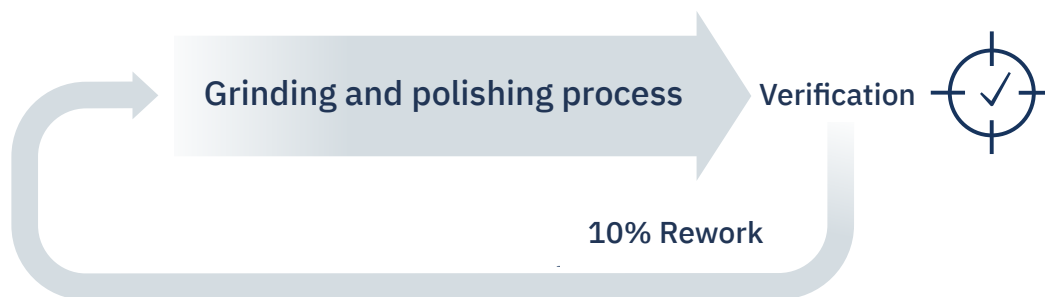


## 4 Less rework

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# GET IT RIGHT FIRST TIME – NO DOUBLE WORK

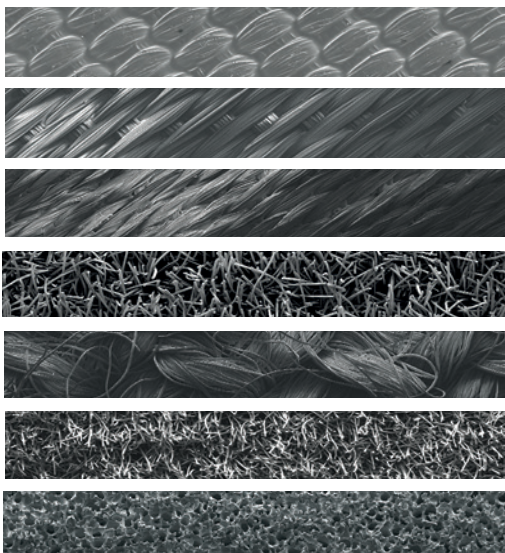
Rework is a non-value-adding activity in which effort, time, materials, and labor are spent correcting errors that should have been avoided. This is a direct result of process variation. Struers has a high focus on reducing process variation when we develop our consumables. This, combined with our highly documented standard methods, enables you to minimize the amount of rework you need to do and ensuring a high process control.



10% rework wastes 10% of



## Designed to work together



No resilience



Each polishing cloth has a unique fabric characteristic to provide optimal performance. Combined with the All-in-One DiaPro suspension dedicated to cloth, the most optimal performance is retrieved supporting a reduction in process variation.

High resilience

## Customer case: Get rid of rework

The example is a simplified version of a true customer case where 15-20% of all samples were failing to meet the preparation requirements. The optimization included correct choice of surfaces to match the actual range of material and exchange of suspensions to products designed for the selected surfaces.

### Alloyed Steel and Ni Alloys

| Conventional method |                                                                                    |                          | Grinding           |                         | Polishing               |                         |
|---------------------|------------------------------------------------------------------------------------|--------------------------|--------------------|-------------------------|-------------------------|-------------------------|
|                     | STEP                                                                               |                          | PG                 | FG                      | DP                      | DP                      |
|                     |   | Surface                  | Other manufacturer | Other manufacturer      | MD-Mol                  | MD-Mol                  |
|                     |  | Suspension/<br>Lubricant | Water              | 6 µm other manufacturer | 3 µm other manufacturer | 1 µm other manufacturer |
|                     | Time (min)                                                                         |                          | Removal of 1000 µm | 7                       | 3                       | 6                       |

**15-20%**  
rework

| Optimized method |                                                                                     |                          | Grinding           |                               | Polishing           |                    |
|------------------|-------------------------------------------------------------------------------------|--------------------------|--------------------|-------------------------------|---------------------|--------------------|
|                  | STEP                                                                                |                          | PG                 | PG                            | DP                  | OP                 |
|                  |  | Surface                  | Stone 4A27         | MD-Allegro                    | MD-Floc             | MD-Nap             |
|                  |  | Suspension/<br>Lubricant | Water              | DiaPro Allegro/<br>Largo 9 µm | DiaPro Floc<br>3 µm | DiaPro Nap<br>1 µm |
|                  | Time (min)                                                                          |                          | Removal of 1000 µm | 7                             | 7                   | 1,5                |

**>95%**  
ready for inspection



By the selection of consumables with highest quality consistency the long steps are not needed for rework reduction but it enables the lab to run different steel types with the same method.

5

Faster preparation steps



# DON'T WASTE YOUR DIAMONDS

A short preparation step will reduce your suspension consumption. Due to the high robustness of Struers' consumables, you can shorten your process steps and still get the high-quality result you need.

## Save up to 47% suspension with short preparation steps

|         | Fine grinding (FG)  | Diamond polishing 3µm | Diamond polishing 1µm | Total dosing minutes | Total suspension consumption | Suspension savings |
|---------|---------------------|-----------------------|-----------------------|----------------------|------------------------------|--------------------|
| Struers | 2 min<br>MD-Allegro | 2 min<br>MD-Dac       | 1 min<br>MD-Nap       | 5 min                | 9 ml                         | –                  |
| Other A | 5 min               | 4 min                 |                       | 9 min                | 17 ml                        | 47%                |
| Other B | 2.5 min             | 2 min                 | 0.5 min               | 5 min                | 15 ml                        | 40%                |
| Other C | 3 min               | 3 min                 | 2 min                 | 8 min                | 13 ml                        | 31%                |

A one-to-one comparison to other products shows that, by enabling short preparation steps, you can reduce your consumable consumption by up to 47 %\*.

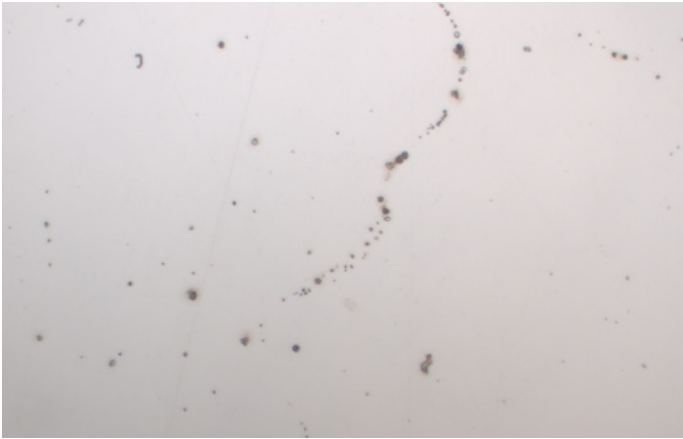
\*Plane grinding is omitted in this example as no dosing of suspension is done in this step

### How short preparation steps save suspension

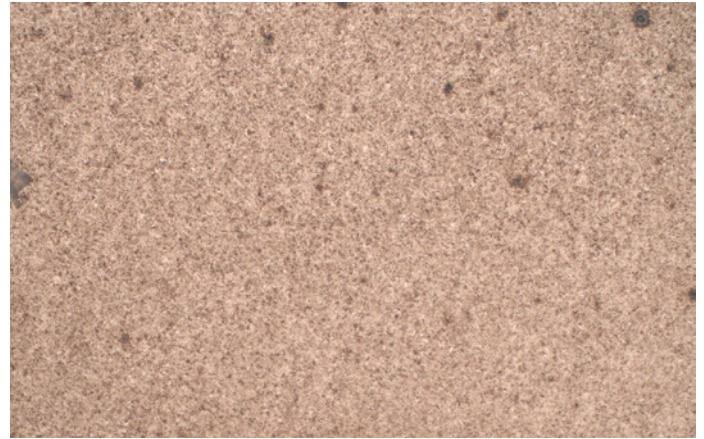


## Final preparation result is not compromised

Struers' efficient grinding and polishing solutions allow for very short preparation times.



Before etching



After etching



Induction hardened steel before and after etching.



## 6 Optimized grinding surfaces

# DON'T DEFORM WHAT YOU CAN'T REMOVE

Deformation is typically introduced during plane grinding due to the need for high removal in this first preparation step. Struers has formulated consumables that ensure your plane grinding step is aligned with the next step in the preparation process. This means that less deformation needs to be removed in the next step, reducing your overall preparation time.

Struers has a large portfolio of rigid MD surfaces, with different patterns and abrasive types, each optimized to a specific material group. This minimizes grinding debris buildup, for consistently high removal and minimal deformation.

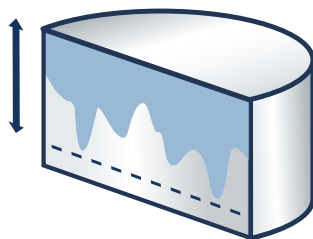
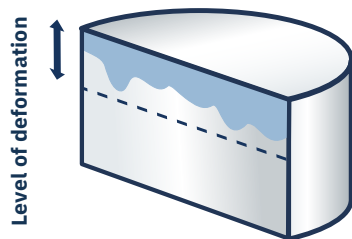
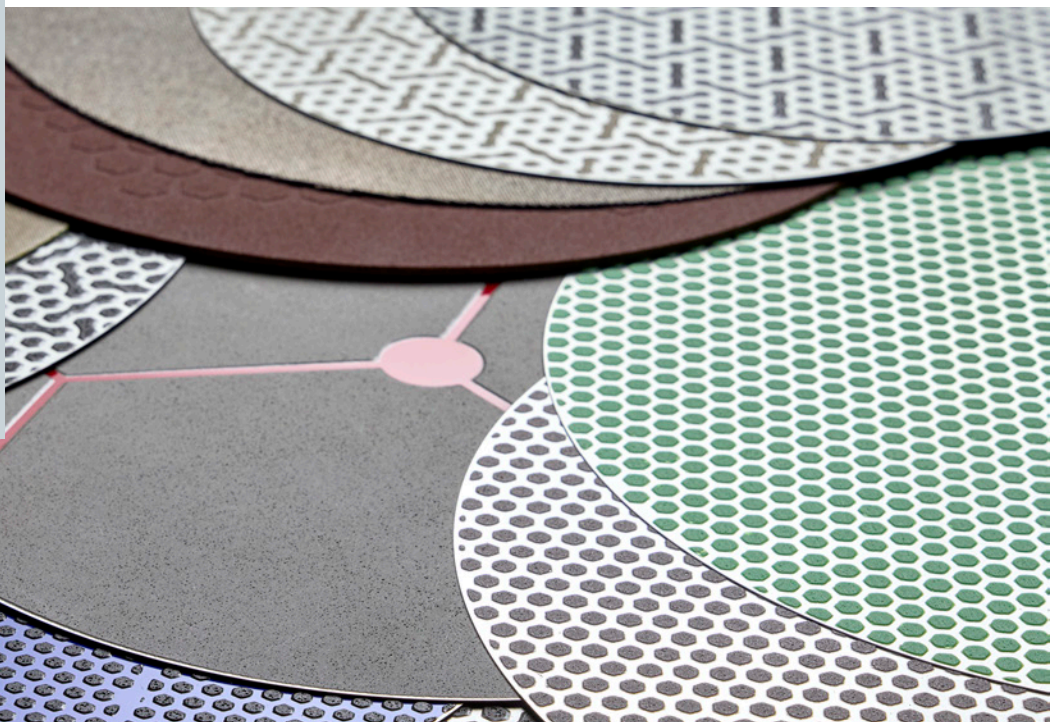


Illustration showing one sample cross-section of a specimen with large deformation and one with little deformation.

Choosing the correct plane grinding surface ensures no extra deformation is introduced.

Reduce time spent  
on the following  
steps by up to

**50%**



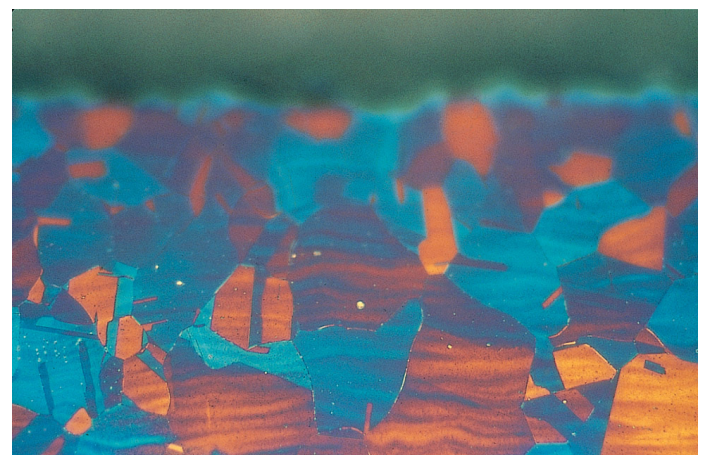
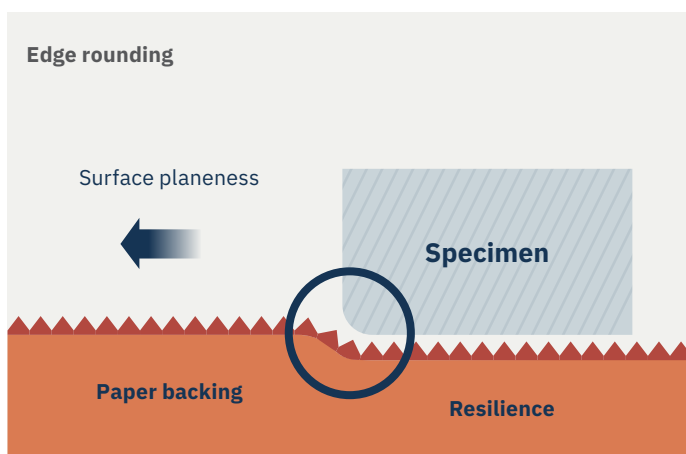
## 7 Planeness

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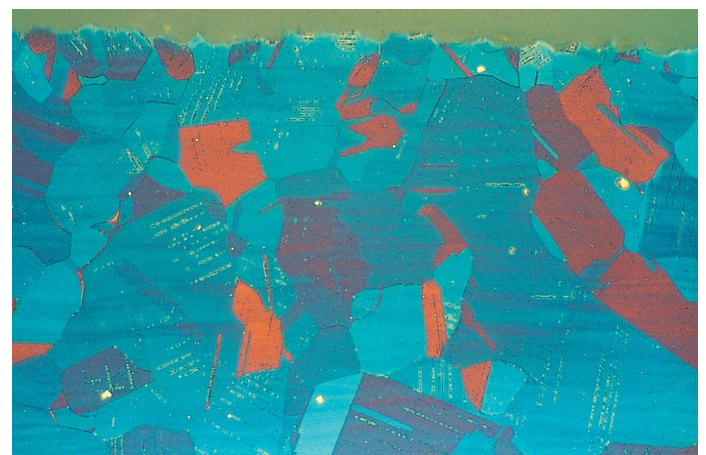
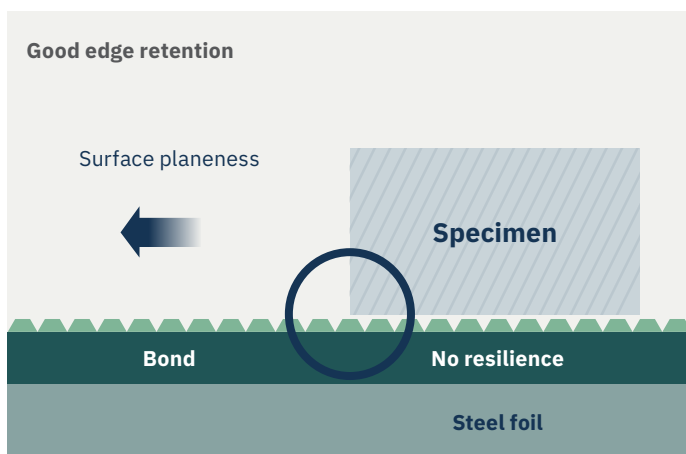
# KEEP YOUR PLANENESS TO THE VERY END

Planeness is a very important parameter if you want to avoid relief in your end result and so ensure easy and correct microscopy – which is of course essential.

Struers has a large portfolio of MD surfaces with different properties, and each is optimized to a specific material group. They all have one thing in common: The ability to keep the specimen plane. This is down to the lack of resilience, which ensures a plane specimen, with no edge rounding or smearing.



1. Edge rounding. Stainless steel.  
Mag: 500x, Etchant: Beraha I



2. Good edge retention, stainless steel  
Mag: 500x, Etchant: Beraha I

The rigid MD surface offers no resilience, ensuring a plane specimen and avoiding edge rounding, smearing, or chipping.

## 8 Cleaning

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# FAST AND EASY CLEANING THAT ANYONE CAN DO

Cleaning your specimens between preparation steps is important to avoid contamination. But it is also time-consuming. In fact, a large part of time spent during the preparation process is dedicated to cleaning. Whether you have an automated cleaning solution or you manually clean your specimens, getting the job done fast and thoroughly is essential if you want to both avoid contamination and reduce time in your preparation process.

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## Cleaning with water only

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### Specimens after flushing with water



Easy and proper cleaning after preparation with DiaPro



Other suspension difficult to clean off with water only.



The all-in-one DiaPro suspension range is developed with easy cleaning as a parameter to be met similar to for instance high and constant removal. An acknowledgment that cleaning is essential for a high quality preparation

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## Automated cleaning – Perfect and fast

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The all-in-one DiaPro suspensions are developed with easy cleaning in mind. A perfect cleaning can also be supported by automated cleaning systems. Either in fully automated equipment as the Xmatic with build in cleaning or in the Lavamin. Lavamin uses a patented, automated process that combines ultrasound and water rinsing, followed by high-speed spin drying.

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### Up to 20% faster

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As an automated process, Lavamin saves up to 20% of the total preparation time and eliminates the need to move specimens to the sink for manual cleaning. This leaves time for you to change the preparation surface and be ready for the next step in the process.

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### Eliminate chemical cleaning

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A reliable rinsing process using only ultrasound and water, followed by high-speed spinning, enables effective cleaning without the use of cleaning agents and alcohol. This helps to make the process safer and lowers your lab's environmental impact.



## Ensuring certainty

Materialographic preparation and testing demands consistent, reproducible results. These come not only from your laboratory process, operators and equipment, but from your supply chain and your partner. As a Struers customer you benefit from high quality design and engineering of equipment and consumables, but just as much from our unique knowledge base, robust global supply chain, and expert service and applications support – where and when you need it. We call all this ensuring certainty

Struers remains dedicated to making the world a better place through the pursuit of deep scientific insights and ground-breaking technology. Today, we're your trusted partner in a fast-changing world, sharing our expertise and practical experience on a global scale. This gives you innovative solutions that help you face the future with confidence. We continue to lead the way in materialographic products and services, and to shape future developments towards a better society.