Microfinish Abrasive Tools

The Power of Precision

THIELENHAUS MICROTOOL

TOP QUALITY THANKS TO HIGH-QUALITY TOOLS

High-quality tools must be used to achieve the highest possible quality and performance in superfinishing. Only a uniform grain size and structure can guarantee compliance with the most exact parameters. The tools offered by the machine manufacturer provide the optimum combination of machine and tool, as they have been manufactured in close coordination with the process development department.

The MicroTool programme from Thielenhaus Microfinish includes stone tools as abrasive and CBN, belt tools as abrasive and diamond as well as polishing tools. All products are characterised by a longer service life and virtually no change in quality between batches. By using MicroTools, an adaption of process parameters after tool change is not necessary anymore.

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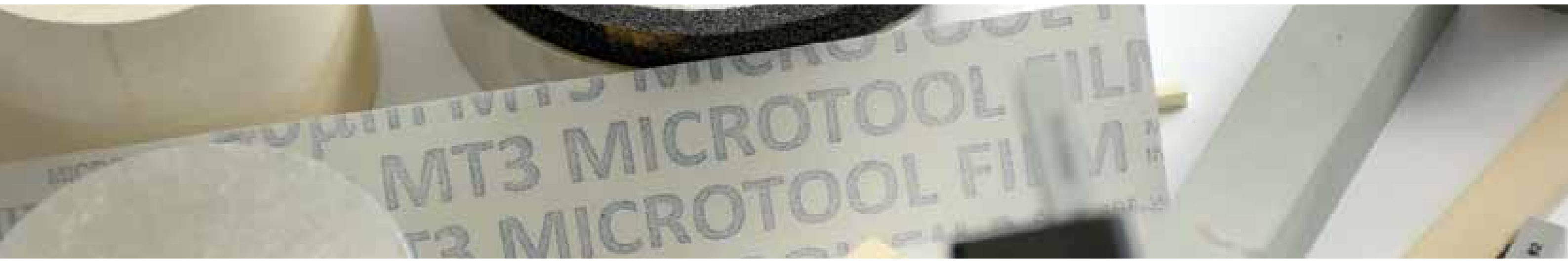
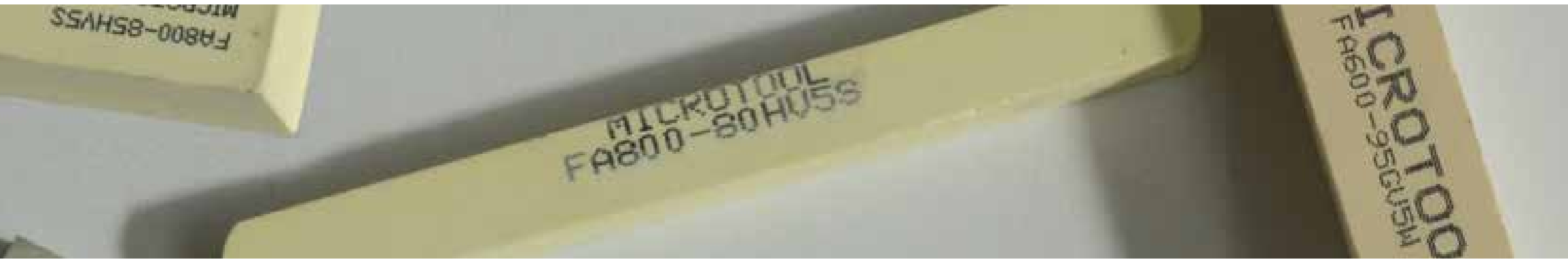


CONVENTIONAL ABRASIVES

Abrasives	Grain	Hardness	Structure	Bond	Treatment
Aluminium oxide	240	20 – Hard	A – Sealed	V – Glazed	W – Wax
WA	280	↓	↓		
FA	320			R – Resin	S – Sulphur
Silicon carbide	400				
GC	500				
C	600				
Ceramics	800				
SA	1,000				
Compounds	1,200				
FG	1,500	280 – Soft	N – Open		

Example:

WA	1,000	–	70	G	V2	S



THE PERFORMANCE OF MICROTOOL ABRASIVES

ABRASIVE TYPES

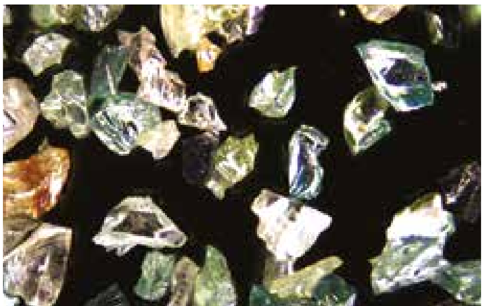
Aluminium oxide is produced during the refining of bauxite ores. The degree of fineness is determined by the colour and toughness of the grain. Thielenhaus MicroTool uses two types of high-purity aluminium oxide grains: Microgrit (WA) is the purest and most brittle form of aluminium oxide. White aluminium oxide (FA) also has a high-purity granularity with a rather angular shape. It is typically used for roughing work.

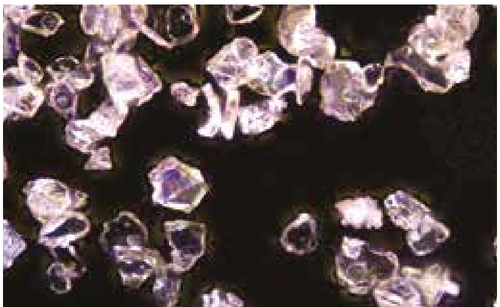
Silicon carbide is made in a furnace by melting white quartz, petroleum coke, sawdust and salt together. Hardness and purity are determined by the colouring of the crystals. Green silicon carbide (GC) is the purest form, while black silicon carbide (C) is a less pure form. Silicon carbide is harder than aluminium oxide and has excellent surface treatment properties.

Although **CBN and diamond materials** have only moderate recognition throughout the industry due to their cost and performance limitations, they are becoming increasingly popular for special applications. Thielenhaus MicroTool offers both diamond and CBN products for use with ceramics, M50 and other materials for orthopaedic implants, bearings and automotive parts. In addition, Thielenhaus MicroTool offers superabrasive abrasives for the production of tapered bearings made of hardened steel.

Graphite is not an abrasive, but is sometimes used to improve the aesthetics of workpieces. Graphite mixtures and abrasives such as aluminium oxide combine the advantages of the lubricity of graphite and the cutting effect of the abrasive material.


Molten white aluminium oxide


Green silicon carbide


Sintered white aluminium oxide

GRAIN

In the superfinishing process, tools with a fine grain size are used to achieve the desired surface finish. The grain of the abrasive is laid down by organisations such as FEPA (Federation of European Producers of Abrasives) and JIS (Japanese Industrial Standards). Most superfinishing processes use conventional abrasives with grains between 400 and 1,200 on the FEPA scale. For some applications, such as miniature bearings, particle sizes in the submicron range are also required. In principle, finer grains can improve the surface quality. The table on the right shows a comparison of the nominal grains of conventional abrasive particles according to FEPA and JIS standards.

FEPA	JIS	Micron
320	500	35
400	700	23
500	1,000	18
600	1,200	14
800	2,000	8
1,000	3,000	5
1,200	4,000	3
1,500	6,000	1

HARDNESS

The degree of hardness is determined by the strength of the abrasives on the substrate. The hardness of a grindstone is determined mainly by the amount of bonding used in its manufacture. Since most applications allow only small tolerances in stock removal rates, surface requirements and cycle times, the production of fine grains and bonded abrasives must be precisely controlled. Thielenhaus MicroTool uses an extremely accurate grading to ensure uniform production of grinding stones and discs. The following table lists some of the factors that need to be taken into account when selecting grades of hardness:

CONSIDERATIONS ON THE DEGREE OF HARDNESS

Harder grades	Softer grades
Low removal rate	High removal rate
Longer service life of finishing stone	More flexible cutting operations
Finer surfaces	Rougher surfaces
Small contact surfaces	Large contact surfaces
Surface finishing positions	Rougher positions
Higher grinding stone pressure	Lower finish stone pressure
Use with softer materials	Use with harder materials

STRUCTURE

The structure is determined by the volume and arrangement of the abrasive grains in the grinding stones or discs. The performance of grinding tools depends on the combination of abrasive grain, bond and structure. The distance between abrasive grains and pores should be equal to ensure consistent performance. Open-structured products offer better clearance room and are less prone to wear than closed-loop grinding tools.

GC600 open structure

GC600 closed structure

BONDS

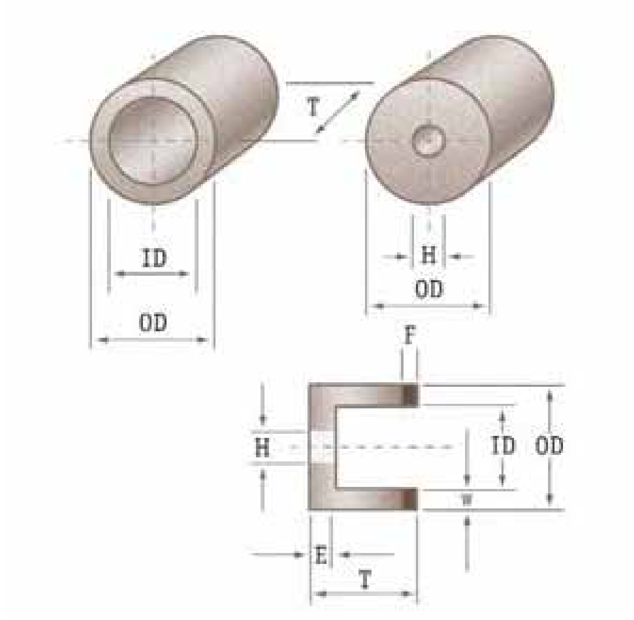
Bonds are used for fixing grain sizes. Although synthetic resin bonds are also plausible, superfinishing tools are usually produced with ceramic bonds that are used to manufacture high-precision products. Ceramic bonds are ideal for automated processes. These bonds are self-levelling, i.e. the production process does not have to be interrupted for levelling. The MicroTool programme contains a large number of bonds especially for bonded abrasives with fine grain size.

TREATMENT

Sulphur or wax is usually used to fill pores. This ensures not only a lubrication of the contact area but also a strengthening of the abrasive particles. Treated tools have better hardness, longer service life, better cutting properties, can handle finer surfaces and are less prone to wear. Sulphur usually offers a higher level of hardness than wax for grinding stones. Wax is used where the typical sulphur stain formation needs to be avoided or where filtration has high priority.

GRINDING STONE AND WHEEL DIMENSIONS

GRINDING STONE MOULDS



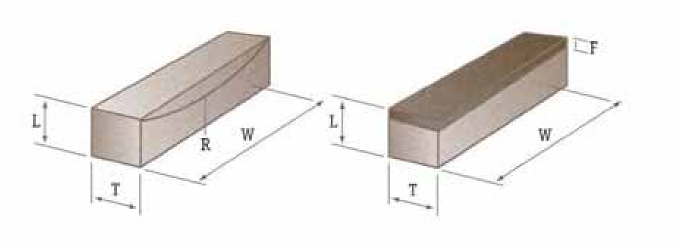
Conventional: OD/ID X T X H; E
Superabrasive: AD/ID X T X H; E (F)

PROPERTIES AND TYPES

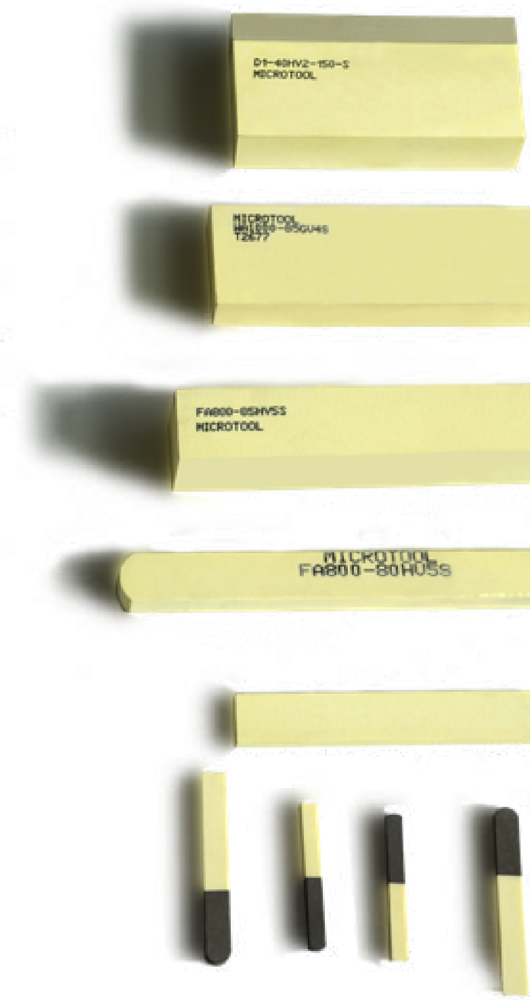
Properties:	Slots, chamfers, holes, angles
Types:	Cup wheels – assembled and in one piece
	Rim discs
	Cylinders
	Mounted cup wheels

GRINDING STONE AND WHEEL DIMENSIONS

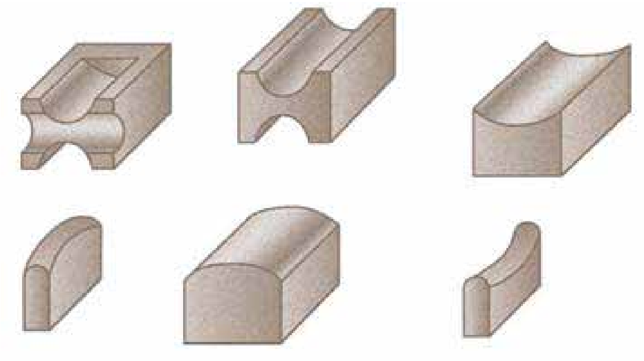
GRINDING STONE MOULDS

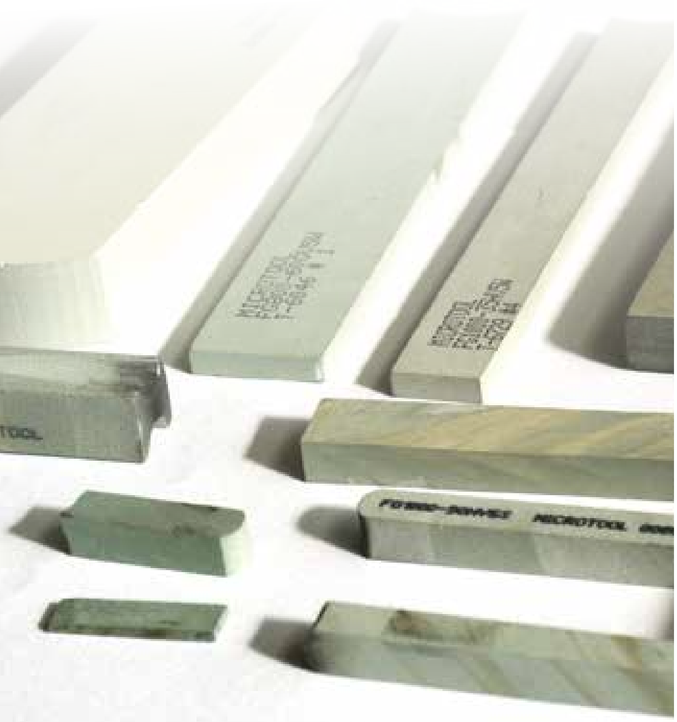


Conventional: T X B X L; R
Conventional: T X B X L; R (F)



SPECIAL SHAPES





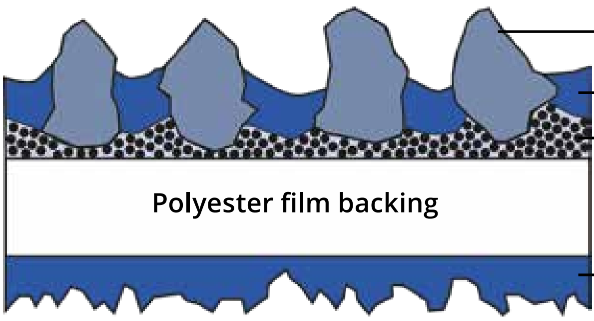
PACKAGING AND LABELLING

ABRASIVE FILM TECHNOLOGY FOR MICROFINISHING

Premium, heat-treated aluminum oxide grain, precision coatings, durable bond and frictional backing technology are uniquely designed for demanding FINISHING applications delivering high stock removal rate, exceptional finish consistently.

FEATURES	BENEFITS
Premium, heat-treated, precision micron-graded aluminum oxide	Superior stock removal rate and consistent finish
Tough, durable, high performance, reinforced adhesive bond system	Higher stock removal rate with better surface finish Excellent adhesion for grain retention contributes to scratch-free, uniform, consistent finishes Excellent durability for long product life
Strong and uniform 5 mil polyester film back with non-abrasive engineered anti-slip back-coat layer	Excellent friction control Non tape slip results in excellent cut and finish Non-abrasive coating for minimum tool wear Universal design for both soft and hard shoes
Full grit range: 100 – 9 micron	Extensive grit offering for broad range of microfinishing / superfinish film applications
Color coded back print by grit size	Ease of product identification
Available in straight and scallop edged rolls	High-precision edge cutting : +/- 0.03mm Custom designed scalloped-edge rolls for perfect fit to finish diesel crankshafts, and curved parts Generate superior part tolerances

MT3 MICROFINISHING FILM DESIGN



Micron graded A/O grains

Tough, durable, resin size coat for high stock removal

High adhesion resin make coat

Engineered back coat
for frictional control

FEATURES

Color coded back print by grit
Engineered frictional coatings for soft and hard shoes

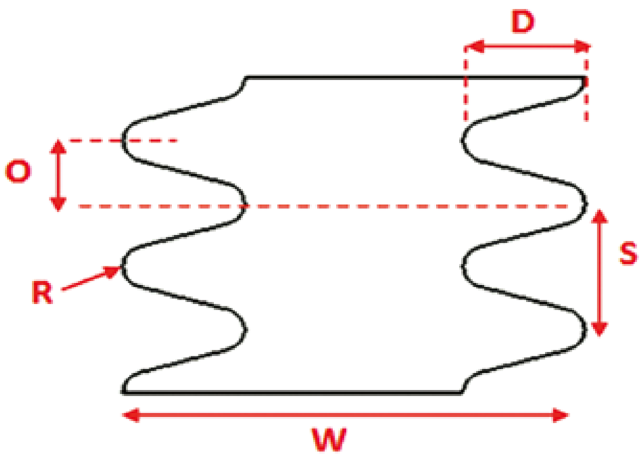
BACK PRINT COLOR	ABRASIVE MICRON SIZE	BACKING	SHAPES AVAILABLE
Purple	80 µm	5 mil and 3 mil Polyester backing with engineered frictional coating	■ Straight-edge rolls ■ Scallop rolls ■ Belts ■ Discs & Sheet with or without pressure sensitive adhesive
Yellow	60 µm		
Black	50 µm		
Blue	40 µm		
Green	30 µm		
Red	20 µm		
Orange	15 µm		
Light blue	9 µm		

MAIN APPLICATIONS

- Camshaft lobes and journals
- Crankshaft mains, pins, thrust walls, and oil seals
- Transmission shafts
- Axles
- Cylinder shaft
- Hydraulic Spool Valves
- Compressor Shafts
- Torque Convertor Covers
- Engine Balance Shaft
- Drive Sprocket Assemblies
- Turbine Shaft
- Gears
- Bearings
- Roll finishing

SCALLOP ROLL SPECIFICATION

- W: Total width
- D: Depth from peak to valley
- S: Step from peak to peak
- R: Radius
- O: Offset from peak on one side to peak on the opposite side (we recommend that O = S/2 or zero)



MAXIMUM PERFORMANCE THROUGH TOOL TRIALS AND TECHNOLOGY SUPPORT

POSSIBLE OBJECTIVES

- New machine installation
- Changing the quality parameters
- Need to improve the workpiece surface / geometry
- Reduction of unit costs
- Change in upstream processes such as grinding
- Implementation of new coolants
- Increased productivity
- New workpiece

PROCEDURE

1. **Definition of goals**
   Development of a clear understanding of the test objectives and possible process considerations. If, for example, the aim is to extend the service life, the use of a harder tool can impair the cutting performance.

2. **Test preparation**
   Make sure that there are enough parts available to perform reasonable tests. Check the condition of the machine and the tools to be used. Establish the quality of incoming parts under normal product conditions. Check suggestions and complaints from people who are familiar with the process.

3. **Establishment of a measurement basis**
   Document the current process. This includes the quality of unmachined and finished parts, stock removal rate, tool life, production rate, fluid conditions and other relevant information.

4. **Carrying out tests**
   The tests must be carefully logged in order to make appropriate comparisons with the current process. Thielenhaus Microfinish recommends carrying out all tests with the same machine. The initial focus should be on the expected workpiece quality before implementing product improvements or cost savings.

5. **Results analysis**
   The added value of alternative grinding tools is determined by comparing the test results with the basic process. The results are to be quantified and the corresponding costs calculated.

GENERAL PROBLEMS AND REMEDIES

PROBLEM	OPERATING PARAMETERS	SELECTION OF THE GRINDING TOOL
Surface		
Surface too rough	Increase spindle rpm	Finer grain size
	Reduce oscillation	Harder grade
	Reduce pressure	Denser structure
Surface too fine	Reduce spindle rpm	Coarse grain size
	Increase oscillation	Softer grade
	Increase pressure	Open structure
Material removal		
Excess abrasive stone wear	Increase spindle rpm	Harder grade
	Reduce oscillation	Denser structure
	Reduce pressure	
	Increase coolant flow	
Decrease in material removal	Increase pressure	Softer grade
	Increase oscillation	Coarser grain size
	Reduce spindle rpm	Open structure
	Check surface of incoming products	
	Check coolant	
Parts quality		
Part not round	Reduce pressure	Softer grade
	Reduce spindle rpm	Open structure
	Increase oscillation	
	Check concentricity	
Chatter marks	Check input quality	
Process problems		
Excessive generation of heat	Check coolant temperature	Softer grade
	Reduce pressure	
	Increase coolant flow	
Wear	Reduce spindle rpm	Softer grade
	Increase oscillation	Coarser grain size
	Check coolant	Open structure
Stone wear		
Uneven grinding stone/grinding wheel wear	Check spindle/partial alignment	Harder grade
Excess grinding stone wear	Increase spindle rpm	Harder grade
	Reduce oscillation	Denser structure
	Reduce pressure	
	Increase coolant flow	

The Power of Precision.

THIELENHAUS
TECHNOLOGIES

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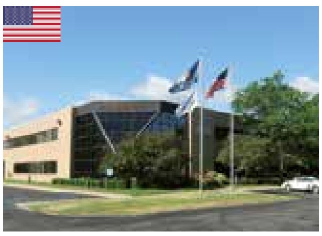

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