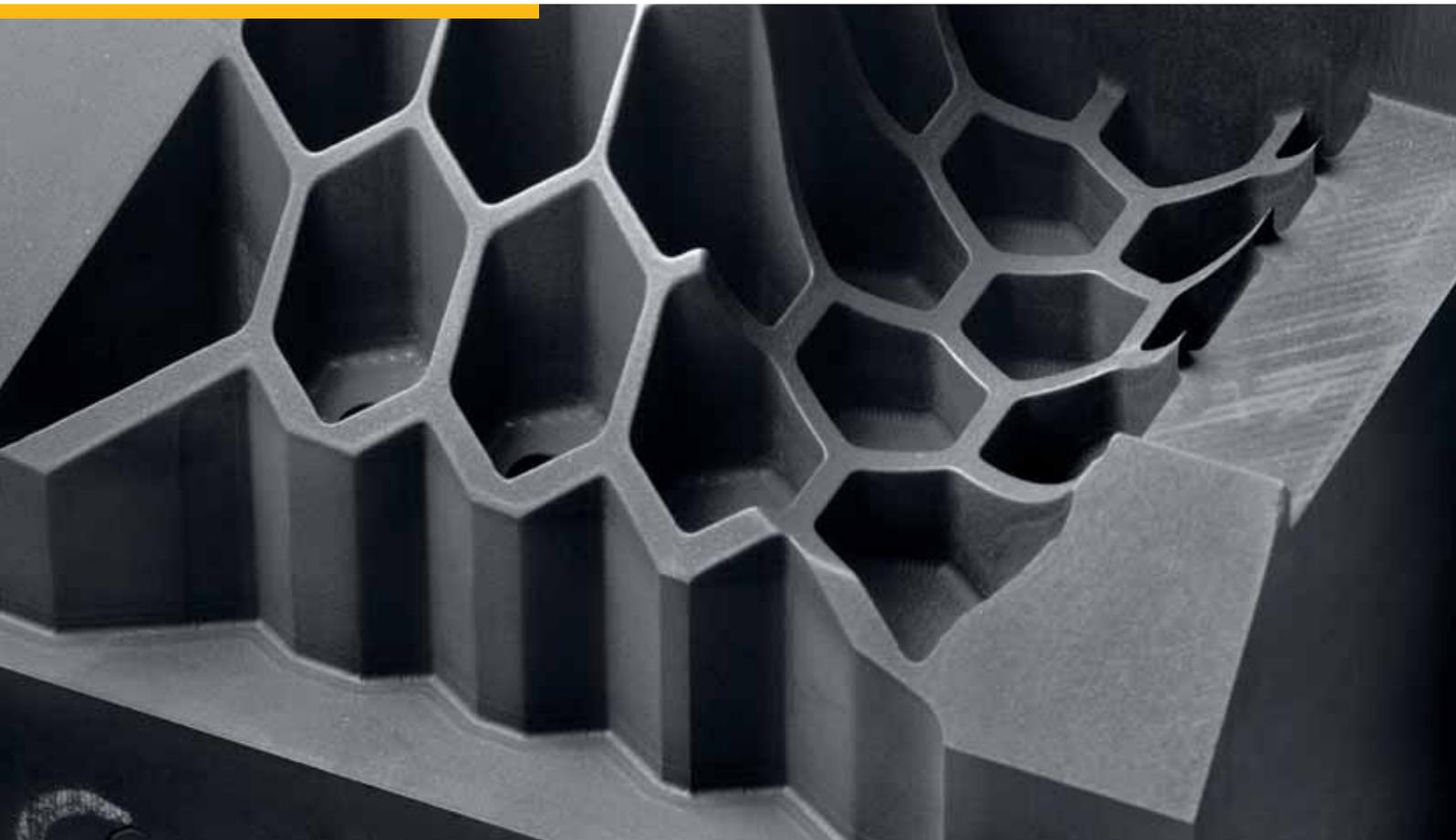




TOYO TANSO 

# Graphite

for E.D.M.



## We Think in Graphite

Graphite is more than just pressed carbon. To us, GTD Graphit Technologie GmbH, it is inspiring, fascinating and exciting at the same time.

We specialize in the most demanding graphite and CFC applications. We consider ourselves to be creators of ideas, development partners and suppliers for the most diverse companies and industries. As a subsidiary of Toyo Tanso Ltd., the world's leading supplier for isostatically pressed fine-grain graphite, we have a market position that opens up doors for us and provides our customers with security.

It is our aim to tread new ground in co-operation with our customers, optimize processes, protect the environment and become a little better every day.

### We work with

- Graphite
- CFC
- Carbon graphite
- Graphite foil
- Coated graphite & CFC



## Our Fields of Competence

Our standardized and individual solutions are based on graphite production from planning all the way to processing by a single company. They stand for high economic efficiency and outstanding quality coupled with maximum supply capability.

They help our customers gain long-term competitive advantages especially in the field of electric discharge machining. We supply graphite for electrodes, semi-finished products and electrode blanks with "ready-to-clamp" hole patterns.

Moreover, we offer special designs of all kinds to our customers.

### Fields of Application

- Roughing
- Finishing
- Fine and super-fine finishing
- Semi-finished products
- Electrode blanks with "ready-to-clamp" hole patterns



## Advantages of Graphite

### Positive Market Development

Due to its technical and economical performance, graphite continues to gain ground as an electrode material in spite of the features offered by high-speed cutting (HSC) in hardened steel. The market will expand further in the coming years especially in Germany.

### Outstanding Material Properties

We only use isostatically pressed graphite from Toyo Tanso. Their extremely high thermal stability allows for high current densities and their low expansion coefficient results in minimal longitudinal expansion and thus the highest eroding precision. Compared to copper, even large electrodes have only minimal moments of inertia because of their low density.

### Advantages of Standardization

We offer our customers all common sizes of standard semi-finished products for electrodes ex warehouse because we want to exploit the economic advantages of graphite as far as possible. This saves time and cost for in-house machining.

### Advantages of Special Solutions

Thanks to our long-term experience we are able to solve complex problems in-house and thus guarantee quality by a single company.

### Reliable Supply Capability

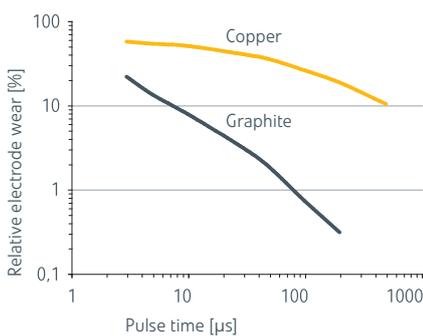
As a subsidiary of Toyo Tanso, we utilize diverse grades of graphite to select the ideal electrode material for each case. Our customers benefit from reliable supply capability and outstanding quality.

### Comprehensive Consultation

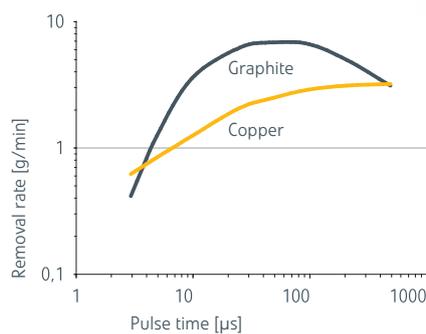
Please ask us about the optimal possible applications of graphite electrodes at your company. We will also be glad to provide advice on the subject of standardization and the resulting potential savings.



Wear



Removal rate



## Cutting and Eroding

### Double Advantages

Compared to other materials, graphite offers clear advantages for cutting as well as eroding. Particularly the low thermal expansion of graphite leads to excellent contour and dimensional stability.

### Graphite Electrodes

Graphite electrodes permit substantial savings in time and cost. Right from the construction phase differently shaped elements can be combined to an electrode to fully exploit the capabilities of modern high-performance erosion machines. Furthermore, the four times lower density makes it possible to handle even large electrodes without any problem and very precisely.

### Advantages

- Lower costs because of long service life
- Precise erosion results
- Higher production figures
- Large electrodes can be used

### Graphite Cutting

The excellent machinability of graphite along with its high resistance and dimensional stability offer time savings of up to 70 % for high-speed cutting (HSC). Because of the excellent material properties it is even possible to manufacture the finest geometries. Since there are no flashes or burrs, manual refinishing is eliminated.

### Advantages

- Lower costs because of low wear
- Higher production figures due to high removal rates
- Finest geometries possible
- No refinishing necessary



## Graphite Machining

### Diverse Capabilities

Graphite is suitable for several machining operations, such as sawing, turning, cutting, grinding, water jet cutting, laser machining and polishing as well as for gluing. To obtain optimal results when using spark erosion, the electrodes must have a high surface quality and the maximum contour accuracy. This can be achieved in the most reliable way by machining with modern high-speed cutters (HSC).

They facilitate particularly fine geometries and very high surface qualities with considerably higher cutting speeds than when machining copper. If the proper cutting strategy and optimally coordinated combination of machine and tools are implemented, up to 70% faster electrode production times can be achieved.

### By the Way:

Just a few basic rules have to be observed when handling graphite dust. We will be glad to inform you about the relevant details.



Cutting	Cutting Speed (m/min)	Feed (mm/tooth)	Cutting Depth (mm)	Cutting Material
Roughing	800 - 1000	0,1 - 0,8		Hard metal, PCD, coated hard metal
Finishing	1000	< 0,08		Hard metal, PCD, coated hard metal
<b>Turning</b>				
Roughing	800 - 1000	0,1 - 0,8		Hard metal, PCD, coated hard metal
Finishing	1000	< 0,08	0,1 - 0,5	Hard metal, PCD, coated hard metal
<b>Grinding</b>				
	1000 ~ 2300	150 ~ 800	< 3	SiC, corundum, diamond
<b>Bandsawing</b>				
	400 ~ 1000	200 ~ 400		HSS, hard metal, diamond

*These recommendations have to be adjusted to the relevant circumstances and represent only approximate standard values.*

# Electrode Production

## Assuring High Quality

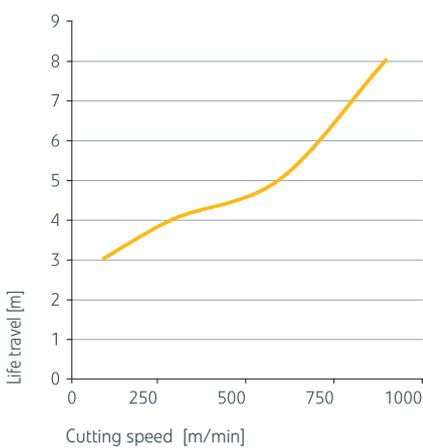
Since graphite cannot be deformed plastically, it cannot be machined in the true sense. Grains are knocked out of the structure in a more or less controlled manner during the corresponding machining process, thus resulting in an abrasive force on the tool's cutting area and requiring a relatively high wear resistance for the cutting material.

We recommend that you work at high cutting speeds to reduce this effect, which occurs during dry machining. In this case optimal machining results are provided by diamond-coated or PCD tools, whose wear decreases with increasing cutting speed and higher feed per tooth. At the same time work results are further optimized by the higher machining speed.

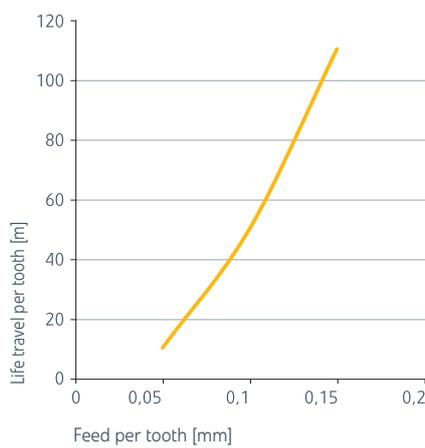
The availability of increasingly powerful HSC cutting machines and tools accelerates and simplifies the use of graphite as an electrode material.



**Cutting Speed**



**Feed**



## Materials

### Roughing/Finishing

ISEM-2 / ISEM-8

**ISEM-2**, a robust material, is most suitable for applications as roughing graphite. It attains surface qualities in the range from VDI 35 to 28.

Versatile universal graphite **ISEM-8** can be used for roughing and finishing. Even finest contours can be achieved because of its good machinability. It achieves surface qualities from VDI 30 to 24.

### Typical Fields of Application

- Molds for housings with larger 3D contours
- Aluminum die-casting



Material	Density	Hardness	Electrical Resistivity	Flexural Strength	Average Particle Size	CTE	Standard Block
	g/cm <sup>3</sup>	Shore	μΩm	MPa	μm	10 <sup>-6</sup> K <sup>-1</sup>	mm
ISEM-2	1,78	55	11,0	41	10	4,6	1.000 x 620 x 305
ISEM-8	1,78	63	13,4	52	8	5,6	1.000 x 620 x 305

*The figures given above are typical values based on our experience and are not guaranteed. Material and production-specific variations have to be taken into account.*

### Roughing/Finishing

TTK-50 / TTK-55 / ISO-63

**TTK-50** is a material of the new graphite generation. It has outstanding properties and covers a large range of different possible applications. Depending on the respective electrode geometry, it may eliminate the use of eroding graphite of higher quality.

When using **TTK-50**, surface qualities from VDI 28 to 21 and less can be achieved.

The further development grade TTK-55 achieves surface qualities from VDI 27 to 20.

A proven material for many years, **ISO-63** is the only graphite in its class available in these large dimensions. It provides for very good surfaces because of its high density and strength as well as its high wear resistance.

### Typical Fields of Application

- Molds for fine contours
- Ribs
- Multi-cavity dies

Depending on the exact configuration and machine technology, **ISO-63** achieves surface qualities from VDI 26 to 20.



Material	Density	Hardness	Electrical Resistivity	Flexural Strength	Average Particle Size	CTE	Standard Block
	g/cm <sup>3</sup>	Shore	μΩm	MPa	μm	10 <sup>-6</sup> K <sup>-1</sup>	mm
TTK-50	1,80	70	13,0	60	6	5,1	1.000 x 540 x 230
TTK-55	1,79	72	14,2	63	5	5,8	1.000 x 540 x 230
ISO-63	1,78	76	15,0	65	5	5,6	1.000 x 540 x 230

*The figures given above are typical values based on our experience and are not guaranteed.*

*Material and production-specific variations have to be taken into account.*

## Premium Materials

### Finishing / Fine and Super-fine Finishing

TTK-4/TTK-5

Both graphite are particularly suitable for demanding and difficult contours. Finest surface structures can be achieved with 3D laser machining. They differ from each other in terms of hardness, compressive and flexural strength.

The softer **TTK-4** displays advantages based on its excellent machinability. The achievable surface quality ranges from VDI 23 to 18.

The harder **TTK-5** is convincing by virtue of its high wear resistance during eroding. Surface qualities from VDI 22 to 17 can be attained.

### Typical Fields of Application

- Molds with filigree structures
- High requirements for surface quality
- High shape precision
- Multi-cavity dies



Material	Density	Hardness	Electrical Resistivity	Flexural Strength	Average Particle Size	CTE	Standard Block
	g/cm <sup>3</sup>	Shore	μΩm	MPa	μm	10 <sup>-6</sup> K <sup>-1</sup>	mm
TTK-4	1,78	72	14,0	73	4	5,0	950 x 510 x 210
TTK-5	1,78	80	15,5	80	4	5,7	950 x 510 x 210

*The figures given above are typical values based on our experience and are not guaranteed. Material and production-specific variations have to be taken into account.*

**Finishing / Fine and Super-fine Finishing**  
TTK-8/TTK-9

The premium graphite **TTK-8** and **TTK-9** are especially suitable for finest machining processes. Their exceptionally high resistance allows for machining of very fine webs and demanding details requiring maximum precision.

**TTK-8** and **TTK-9** differ in terms of hardness, compressive and flexural strength.

The softer **TTK-8** is easier to machine with maximum precision. Surface qualities from VDI 21 to 15 can be achieved.

The main priority for the clearly harder **TTK-9** is a perfect final result with surface roughness from VDI 21 to 14 and less!

**Typical Fields of Application**

- Molds for finest structures
- Highest requirements for surface quality
- Highest shape precision
- Multi-cavity dies



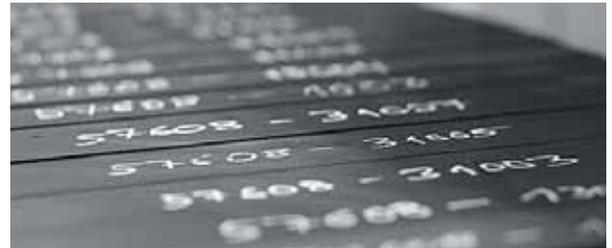
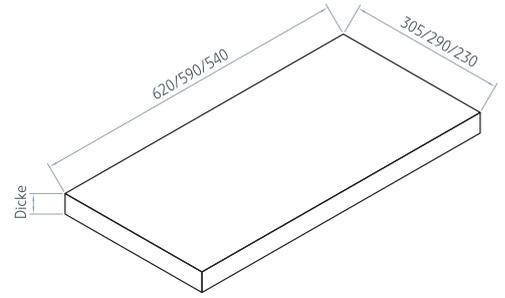
Material	Density	Hardness	Electrical Resistivity	Flexural Strength	Average Particle Size	CTE	Standard Block
	g/cm <sup>3</sup>	Shore	μΩm	MPa	μm	10 <sup>-6</sup> K <sup>-1</sup>	mm
TTK-8	1,77	78	15,0	80	2	4,9	700 x 400 x 150
TTK-9	1,77	90	18,0	92	2	5,1	700 x 400 x 150

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## Plates and Rods

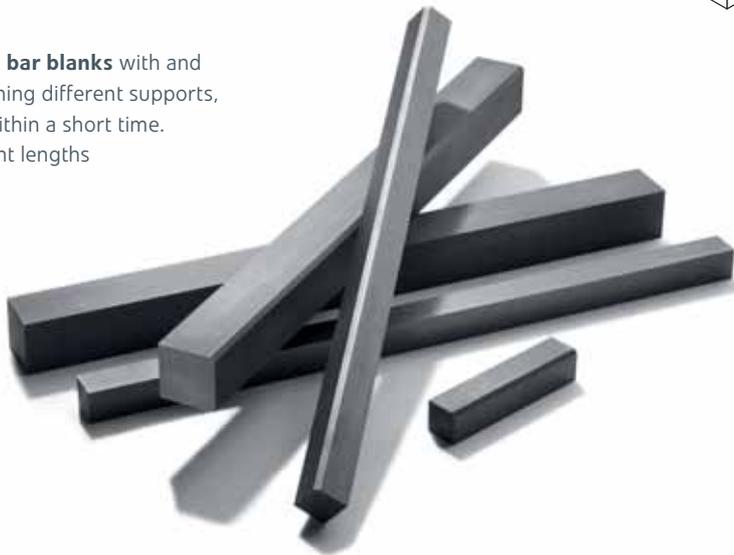
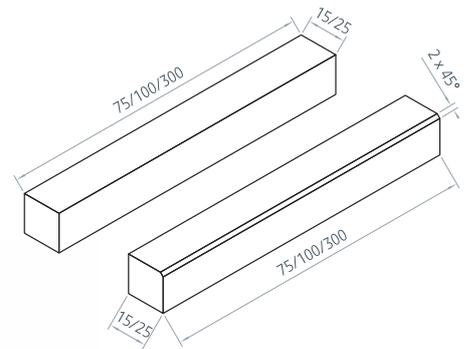
With precision-sawn **plates and rods** we already achieve high surface qualities during the sawing process. In most cases the surfaces do not require any more cutting or grinding. Due to the availability of finely stepped thickness dimensions the required sections can easily be manufactured by the customer. This saves time and increases flexibility.

All plates and rods are available in a great variety of graphite grades. You will find the current dimensions and prices in the separate price list.



## Square Bars, Foil Sheets, Round Bars, Rib Electrodes

Completely cut **square bar blanks** with and without chamfer matching different supports, are ready-to-deliver within a short time. In this case the different lengths reduce any offcut.



Semi-finished products in the form of **foil sheets, round bars** and **rib electrodes** facilitate the immediate completion of standardized erosion applications.

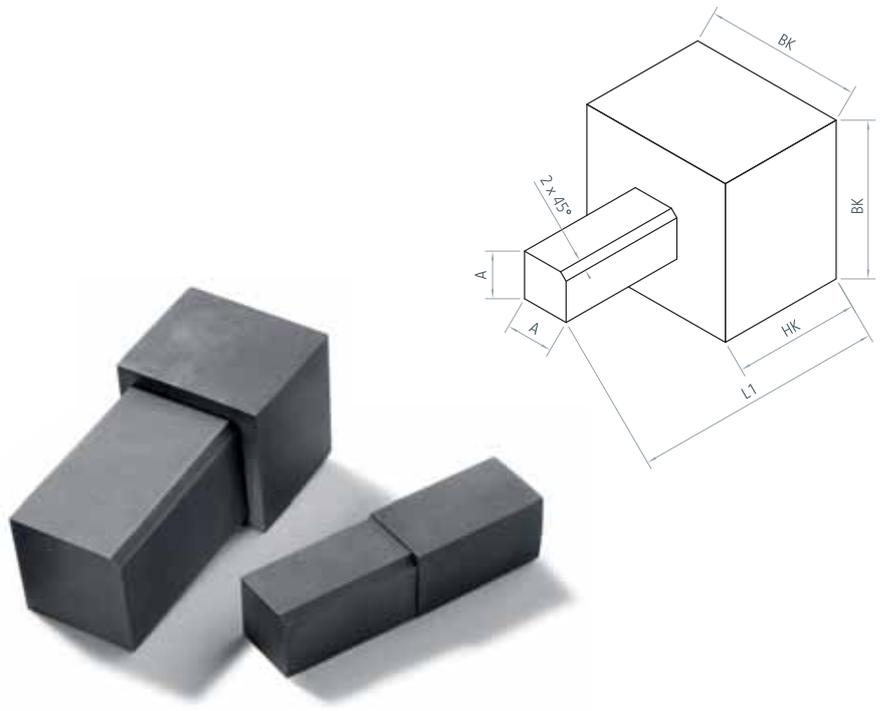


## Head Electrodes

**Head electrodes** enable application of larger electrodes on smaller supports. The shaft is completely cut and the head is sawn.

We also manufacture head electrodes according to your specifications, of course.

We continuously expand our standard range of dimensions. You will find the current dimensions and prices in the separate price list.



## Clamping system GTD

The **clamping system GTD** can be used in nearly every clamping system for square rods. It combines the advantages of head electrodes with an optimized material utilization and fabrication. The supply from stock guarantees maximum flexibility using these standard parts



## Electrode Blanks with "Ready-to-Clamp" Hole Patterns

### Key Competences

Manufacturing electrode blanks with hole patterns for support systems involves deployment of human resources and may block cutting machines for longer periods of time.

To reduce these periods of time and lower costs at the same time, we provide a large selection of electrode blanks with hole patterns ex warehouse. According to our experience, they cover about 80% of all possible tasks.

We manufacture low-cost graphite sections with hole patterns for all usual support systems such as Erowa, 3R, Hirschmann, REF System or Mecatool. Naturally we implement your individual specifications precisely and within a short time.

### Advantages of Electrode Blanks with Hole Patterns

- Immense cost saving
- Shorter delivery times, maximum availability
- More free machine time
- Lower personnel costs

We continuously expand our range of dimensions.

You will find the current dimensions and prices in the separate price list.



# Overview

## Materials

Material	Density	Hardness	Electrical Resistivity	Flexural Strength	Average Particle Size	CTE	Standard Block
	g/cm <sup>3</sup>	Shore	μΩm	MPa	μm	10 <sup>-6</sup> K <sup>-1</sup>	mm
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## Achievable Surface Qualities

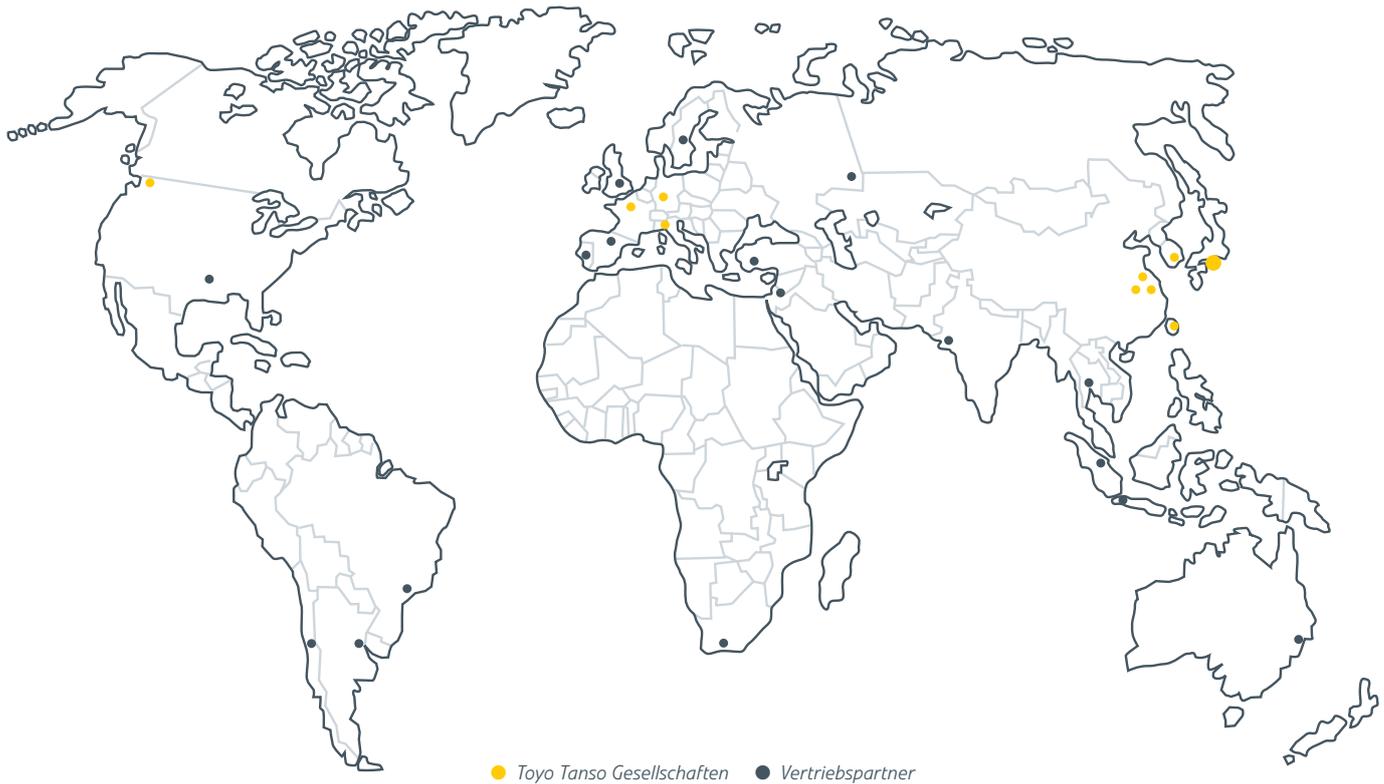
VDI Normal	38	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
Ra (μm)	8,00			5,00				3,15				2,00				1,25				0,80				0,50
R max (μm)	63-40			40-25				25-16				16-10				10-6,3				6,3-4				4-2,5
ISEM-2	[Bar chart showing achievable surface qualities for ISEM-2]																							
ISEM-8	[Bar chart showing achievable surface qualities for ISEM-8]																							
TTK-50	[Bar chart showing achievable surface qualities for TTK-50]																							
TTK-55	[Bar chart showing achievable surface qualities for TTK-55]																							
ISO-63	[Bar chart showing achievable surface qualities for ISO-63]																							
TTK-4	[Bar chart showing achievable surface qualities for TTK-4]																							
TTK-5	[Bar chart showing achievable surface qualities for TTK-5]																							
TTK-8	[Bar chart showing achievable surface qualities for TTK-8]																							
TTK-9	[Bar chart showing achievable surface qualities for TTK-9]																							



### We look forward to your call

Our experienced sales team as well as our application engineers will gladly advise you (also on site, if you wish) and will develop together with you the best solution for your requirements.

## Ideas for Innovations



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