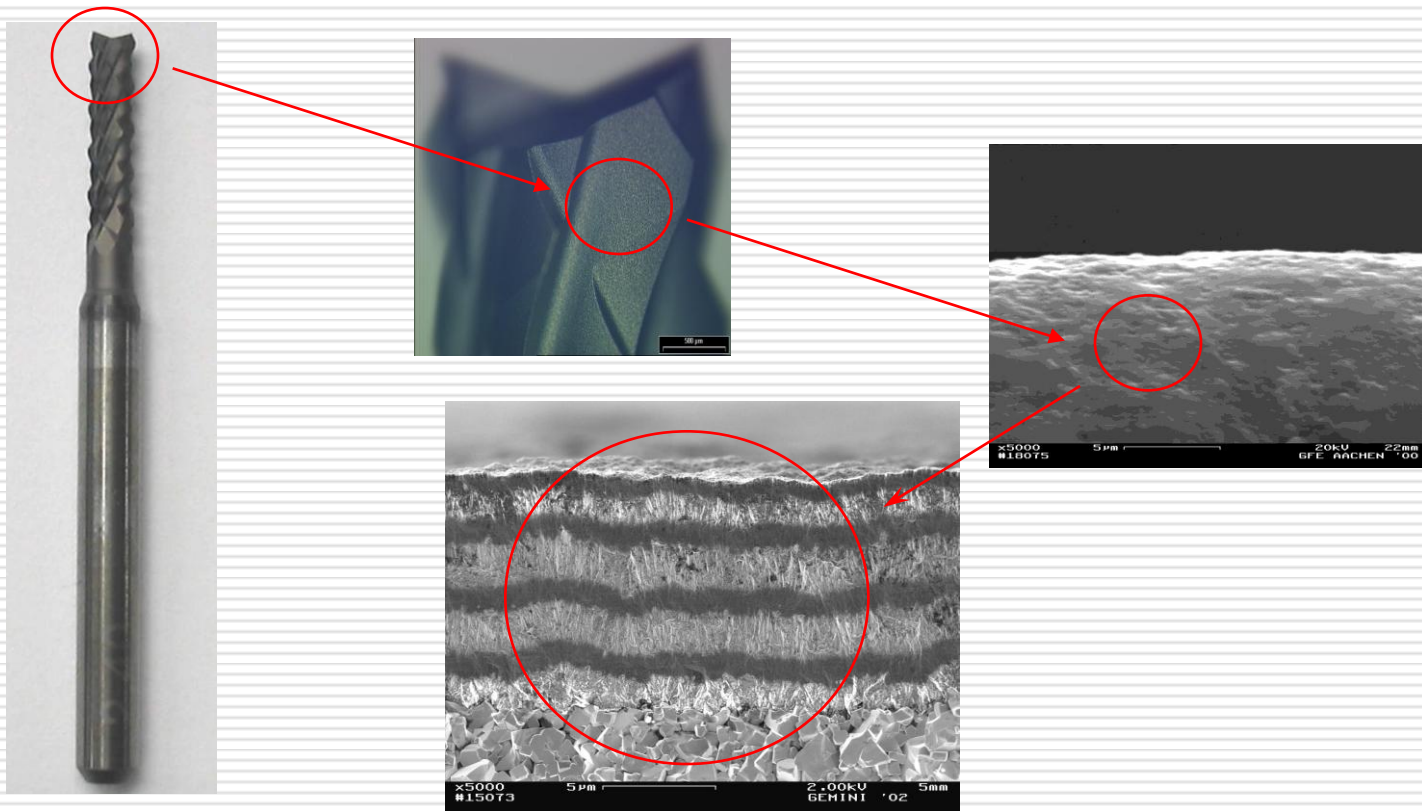


Topics

- ❖ **Diamond coating**
- ❖ **Coating device**
- ❖ **Diamond coated router**
- ❖ **Diamond coated drill**

❖ Diamond coating



❖ Coating device

Diamantbeschichtungstechnologie

CEMECON
Coatings, Technology & Process



CemeCon AG • Würselen

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- ❖ **Diamond coated router**
- ⇒ **PCB router geometries**
- ⇒ **Current applications**
- ⇒ **Quality requirements**
- ⇒ **Calculation of tolerances**
- ⇒ **Advantages / cost savings**

⇒ **PCB router geometries**

- **spiral cut** **$\varnothing \geq 0.40$ mm**
- **diamond cut** **$\varnothing \geq 0.80$ mm**
- **2-flute** **$\varnothing \geq 1.00$ mm**

⇒ Current applications

- **Telecommunication**
- **Network**
- **Automotive**
- **High Frequency Products**
- **Industrial Electronics**
- **Depaneling of PCB**

➤ Telecommunication: Mobile Phones

- **Material:** FR4, standard or halogen free
- **Stack height:** 4 - 6 panels per stack
- **GCT router:** 1 100 / 1 200 / 1 260
diameter 1.00 - 2.00 mm
flute length 5.20 - 9.00 mm
- **Spindle speed:** 32 - 70000 rpm
- **Feed rate:** 0.60 - 1.20 m/min
- **Tool life:** 50 - 180 m

➤ Network

- **Material:** FR4, up to 400 μm copper / layer
- **Stack height:** 2 - 3 panels per stack
- **GCT router:** 1 100
 - diameter 2.00 mm
 - flute length 9.00 mm
- **Spindle speed:** 30000 rpm
- **Feed rate:** 0.50 m/min
- **Tool life:** increases by factor 12

➤ Automotive

- **Material:** FR4, standard and high Tg
- **Stack height:** 2 - 3 panels per stack
- **GCT router:** 1 100 / 1 200
diameter 1.00 - 2.40 mm
flute length 5.00 - 10.00 mm
- **Spindle speed:** 24 - 70000 rpm
- **Feed rate:** 0.60 - 1.40 m/min
- **Tool life:** 100 - 300 m

➤ High Frequency Products

- **Material:** Rogers 4350
- **Stack height:** 2 panels per stack
- **GCT router:** 1 100
 - diameter 1.60 – 2.40 mm
 - flute length 7.50 – 9.00 mm
- **Spindle speed:** 24 - 36000 rpm
- **Feed rate:** 0.80 - 1.40 m/min
- **Tool life:** 40 - 60 m

➤ Industrial Electronics

- **Material:** FR4, standard and high Tg
- **Stack height:** 2 - 4 panels per stack
- **GCT router:** 1 100 / 1 200
diameter 1.00 - 2.50 mm
flute length 5.00 - 10.00 mm
- **Spindle speed:** 24 - 60000 rpm
- **Feed rate:** 0.60 - 1.40 m/min
- **Tool life:** 100 - 350 m

➤ Depaneling of PCB

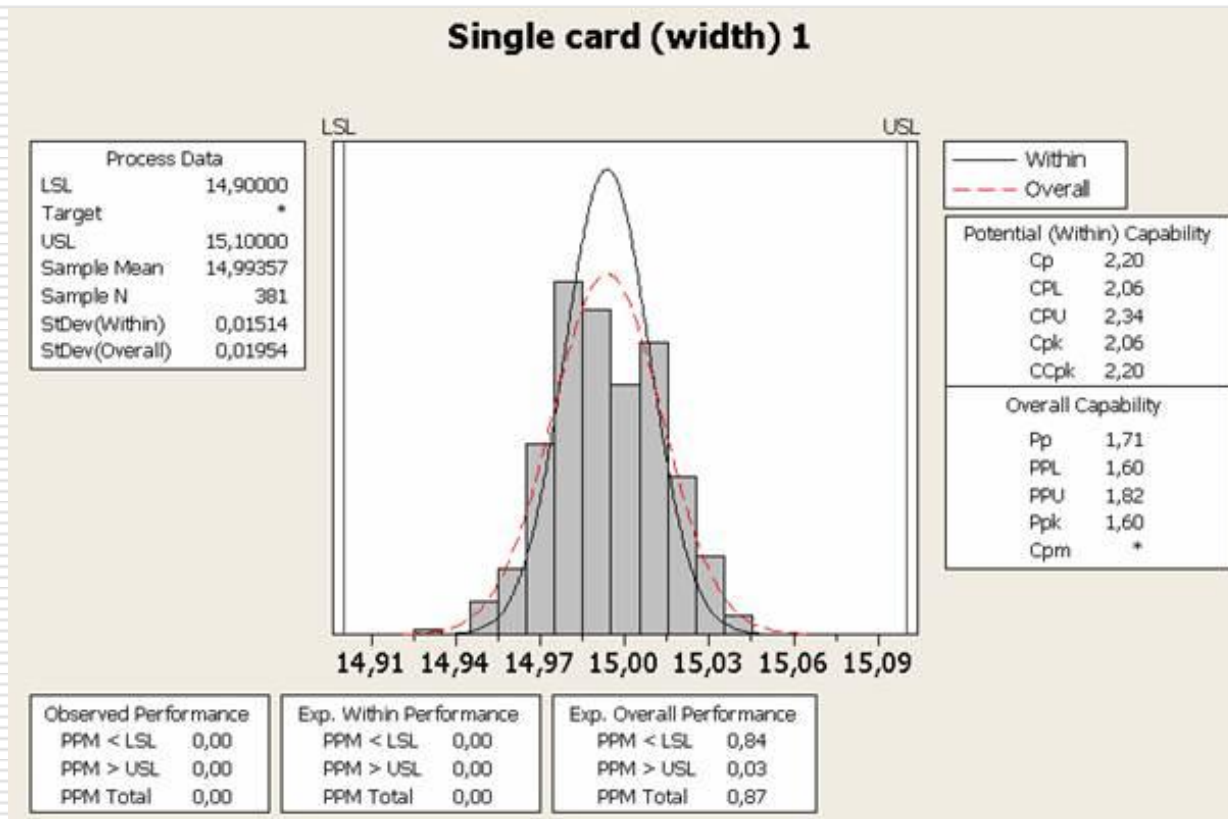
- **Material:** FR4
- **Stack height:** 1 panel
- **GCT router:** 1 100 / 1 200 / 1 260
diameter 1.50 - 3.00 mm
flute length 7.50 - 10.00 mm
- **Spindle speed:** 22 - 60000 rpm
- **Feed rate:** 0.80 - 3.00 m/min
- **Tool life:** 200 - 800 m

⇒ Quality requirements

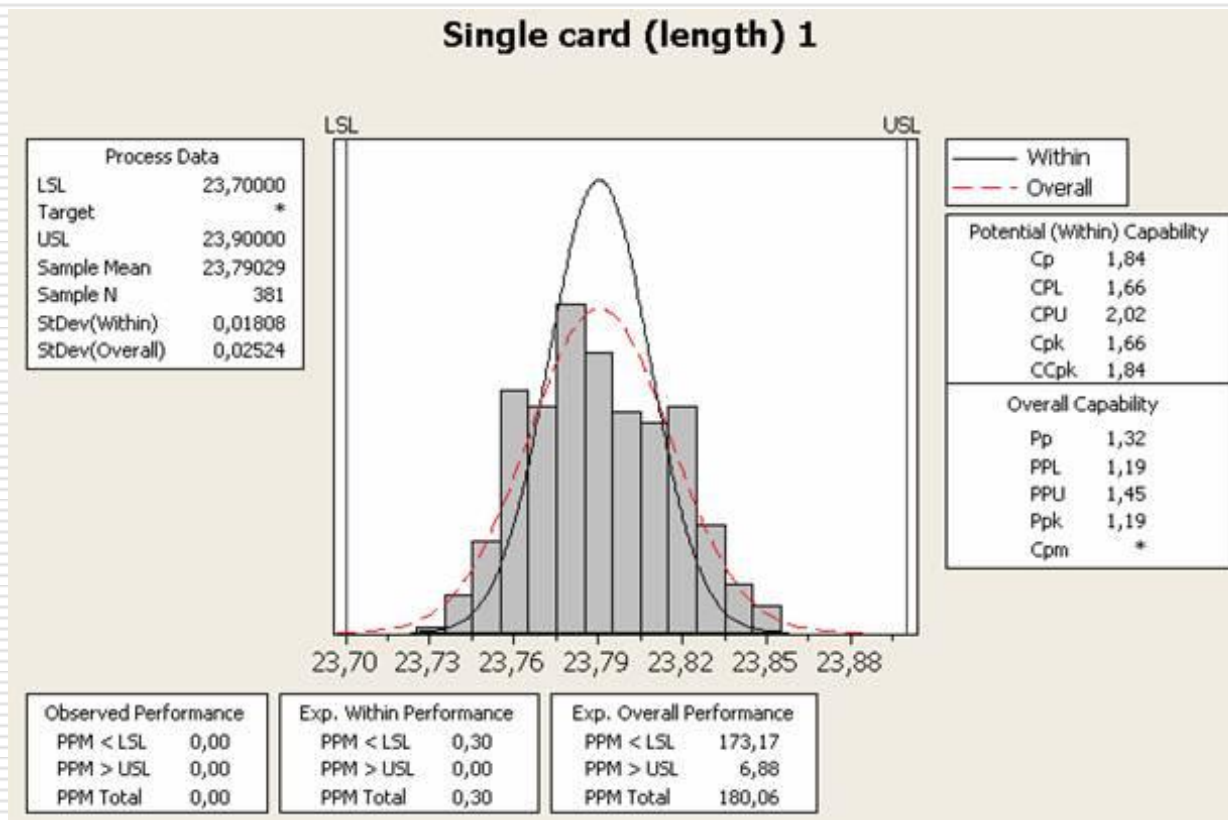
➤ Tighter tolerances of PCB are requested:

± 0.10 mm & ± 0.05 mm

⇒ Quality requirements



⇒ Quality requirements



⇒ Calculation of tolerances e.g. \varnothing 2.00 mm

Influences	Carbide router	Diamond coated router
➤ Router \varnothing	30 μm	<20 μm
➤ Wear at router \varnothing	50 μm	<10 μm
➤ Deviation of router	70 μm	50 μm
➤ Machine and fixture	30 μm	20 μm
➤ Total tolerance	180 μm	<100 μm ✓

⇒ Advantages / cost savings

When using diamond coated router you will benefit from:

- better process capability ⇒ lower dimensional tolerances
- most favorable tool for higher requirements on high Tg applications
- cost savings of 25-35%

⇒ Advantages / cost savings

- | | | |
|--------------------------------------|------------------|------------------|
| - carbide router | 6000 pcs | 6000 Euro |
| - diamond coated router | 1000 pcs | 4700 Euro |
| ➤ savings in tool costs | > 20 % | 1300 Euro |
| - less tool changing and handling | | |
| ➤ longer machine running time | 10-20 % | |
| ➤ total cost savings: | 30-40 % | ✓ |

❖ **Diamond coated drill**

⇒ **PCB drill geometries**

⇒ **Current results**

⇒ **PCB drill geometries**

- **undercut** **Ø 0.50 – 1.25 mm**
- **straight type** **Ø 1.30 – 3.175 mm**
- **tapered** **Ø ≥ 3.20 mm**

⇒ Current results 1

Drilling of back panels

- **Material:** Isola P95, Tg 260°C, 22 layers
- **Stack height:** 1 panel, 4.00 mm thick
- **GCT drill:** 1 638
diameter 0.55 mm
flute length 7.00 mm
- **Spindle speed:** 114.000 rpm
- **Feed rate:** 2.50 m/min
- **Tool life:** 10.000 hits

⇒ **Current results 1**

Drilling of back panels



⇒ Current results 2

Drilling of back panels

- **Material:** Isola P95, Tg 260°C, 20 layers
- **Stack height:** 1 panel, 4.00 mm thick
- **GCT drill:** 1 638
diameter 0.55 mm
flute length 7.00 mm
- **Spindle speed:** 117.000 rpm
- **Feed rate:** 2.30 m/min
- **Tool life:** 8.000 hits

⇒ **Current results 2**

Drilling of back panels

