Processing of carbide drills

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1. Job Definition

10 µm– 90µm rounding of the cutting edge, depending on the application.

When rounding the cutting edge, the following needs to be considered:

- Rounding of the cutting edge larger than 60 µm, the cutting edge should be chamfered with a similar size than the desired radius. Best would be 10-20% smaller.
- The cutting corner should not be rounded more than 30% of the main cutting edge.
- To avoid a built-up edge, especially when processing titanium and aluminium, a polished tool is benefiting.
- Using HSC 1/300, a cutting edge of 16 µm can be achieved. The cutting corner will not be rounded more than that.
- Using HSC 4/400 or M4/300, a cutting edge of 10 µm can be achieved.
- In order that the bore hole stays straight, both main cutting edges shall be not more unequally rounded than +- 5%.
- In case you process the cutting tool in 100% clockwise direction, you can achieve a K-factor >1.
- The influence of the parameters on rounding of the cutting edge and jaggedness in the OTEC machine is as follows:

  Rounding of the cutting edge:
  -process time: ca. 40%
  -speed of rotor: ca. 30%
  -speed of holders: ca. 20%
  -direction of rotation: 10% (clockwise leads to more rounding)

  Jaggedness:
  - process time: ca. 15%
  - speed of rotor: ca. 5%
  - speed of holders: ca. 15%
  - direction of rotation: 23% (counter clockwise leads to smoother surfaces)

Recommended rounding at the cutting edge(e.g.: drill, diameter 10 mm):

- Processing of wood: 4 to 6 µm
- Processing of aluminium 6 to10 µm
- Processing of steel 4 µm x diameter of the tool

Typical process parameters:

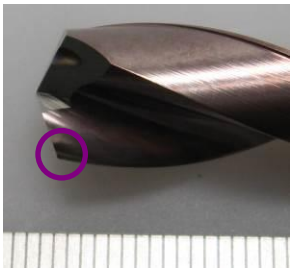
Machine:	DF-3 Tools	
Media:	HSC 1/300	cutting edge radius up to 16 µm
	H4/400	cutting edge radius up to 12 µm
	TZM	cutting edge radius up to 30 µm
	TZMS	cutting edge radius up to 90 µm
Process time:	4 to 45 min.	

2. Parameters and machine data

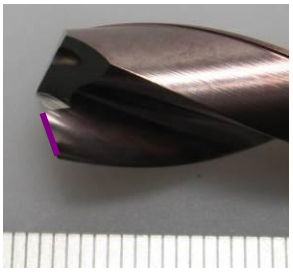
Tool	Ø	Rounding of the cutting edge before processing (µm)	Rounding of the cutting edge after processing (µm)	Media	Speed Rotor [min-1]	Speed of holders [min-1]	Direction of the rotor	time (min.)	Angular holder	Immersion depth
Drill	4	5,1	9,5	HSC 1/300	45	96	50%-50%	8	-	max
Drill	5	2,8	11,7	HSC 1/300	45	96	50%-50%	10	-	max
Drill	5	7,8	31,5	TZM 2/3	45	20	50%-50%	20	-	max
Drill	7	5,7	55	TZMS 4/5	45	20	50%-50%	7	-	max
Drill	10	2,8	11,7	HSC 1/300	45	96	50%-50%	10	-	max
Drill	10	3,5	15	HSC 1/300	45	96	50%-50%	13	-	max
Drill	10	4,5	25	TZMS 4/5	45	20	50%-50%	2	-	max
Drill	10	3,7	40	TZMS 4/5	45	20	50%-50%	4	-	
Drill	12	6,7	21,8	TZMS 2/3	45	20	50%-50%	5	-	
Drill	12	6,7	26,8	TZMS 2/3	45	20	50%-50%	6	-	
Drill	12	6,7	36,8	TZMS 4/5	45	20	50%-50%	10	-	
Drill (droplets removal)				HSC 1/300	45	96	30 sec to the right,120 sec to the left	2,5		max

2.1 Example: Uniform rounding of the cutting edge

Measuring points



Cutting corner (SE)



main cutting edge (HS)

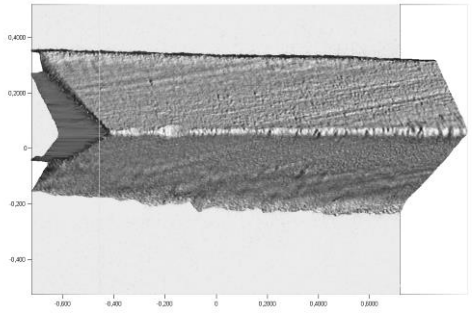
Rounding of the cutting edges: Drill ø10

		main cutting edge 1			main cutting edge 2		
Condition	**No**	**HS**	**SE**	**Jaggedness**	**HS**	**SE**	**Jaggedness**
Before processing	-	4	11	0,6	4	11	0,6
After processing	1	23	28	0,2	21	27	0,5
After processing	2	21	32	0,6	19	31	0,7
After processing	3	20	34	0,4	19	34	0,7
After processing	4	18	28	0,5	19	30	0,4
After processing	5	22	30	0,3	21	28	0,4
After processing	6	21	20	0,5	21	23	0,5

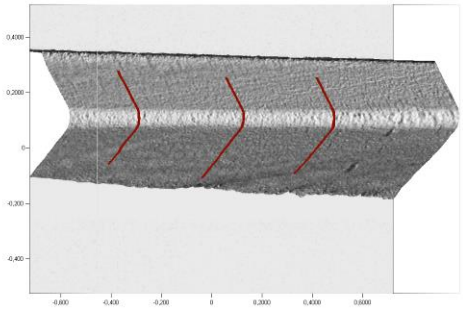
Process parameters: DF-Tools with additional drive

2.2 Examples for rounding of the cutting edges before - after

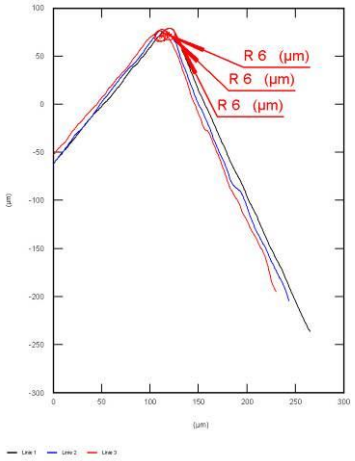
Processed in driven holder. Rotation: 50% clockwise, 50% counter clockwise.

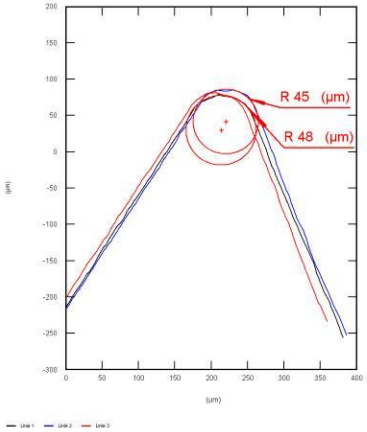


Before processing



After processing

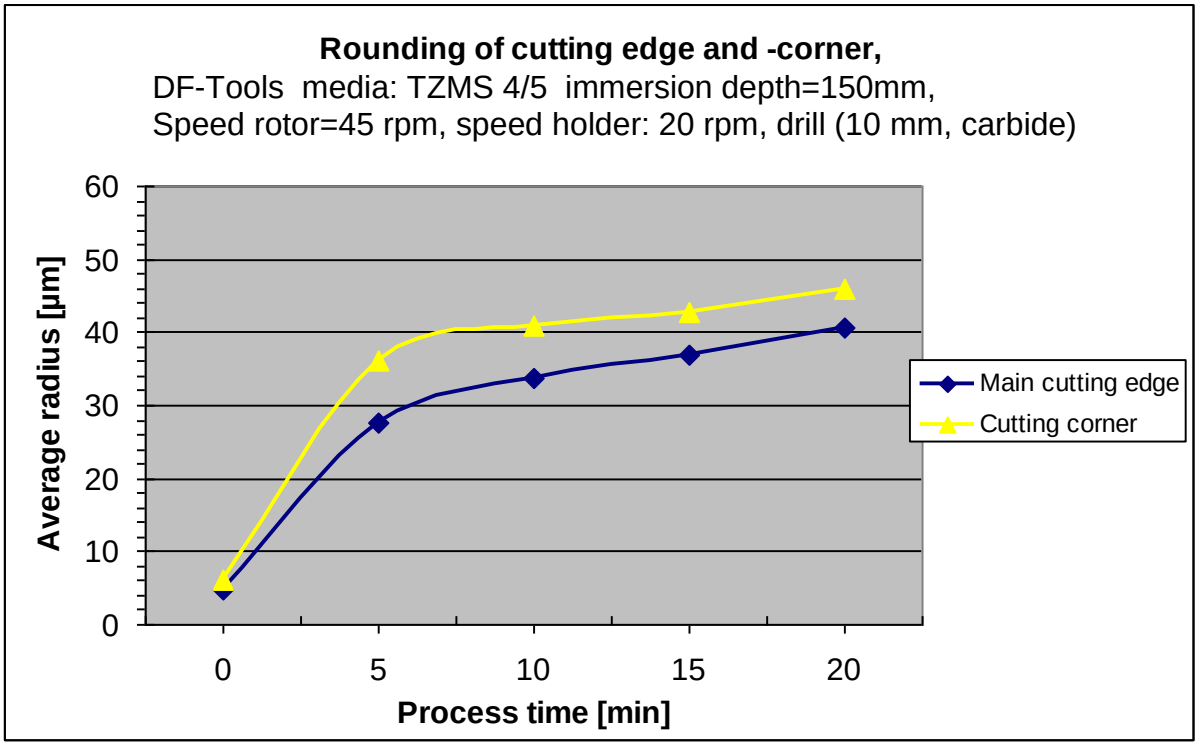




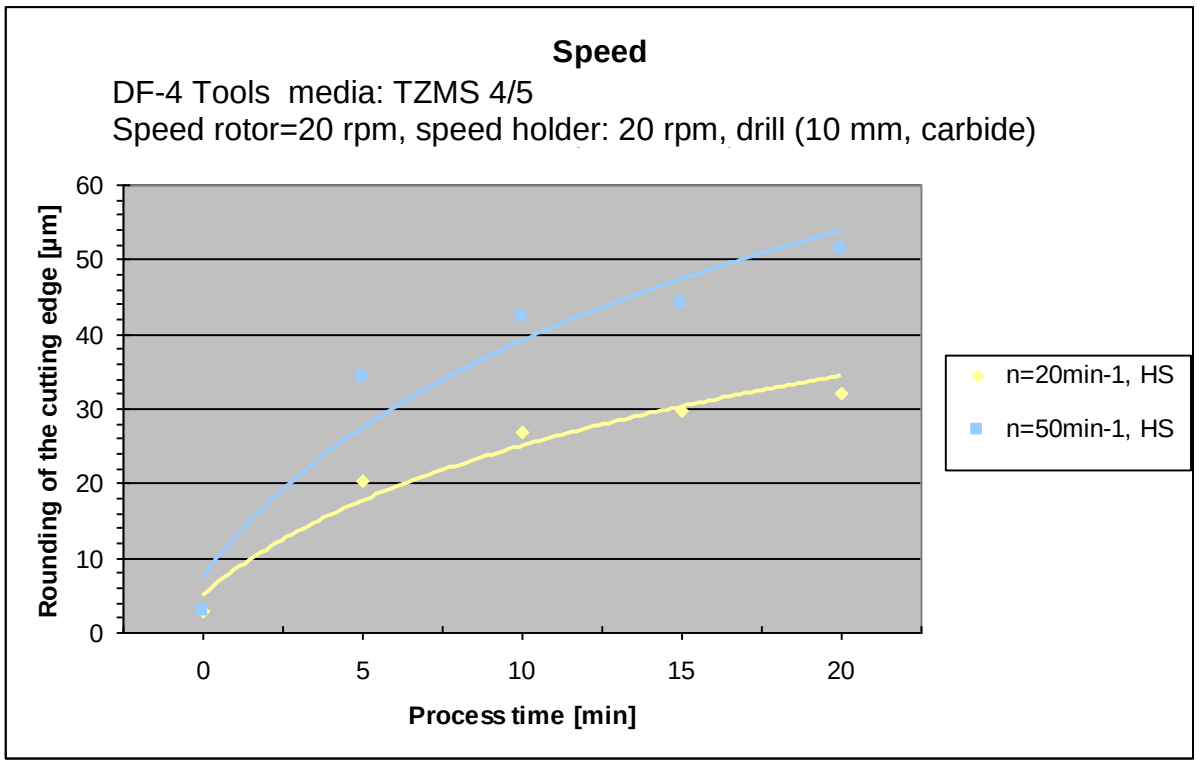
For processing aluminium, a tool polished with H4/400 was found very benefiting.

3. Some charts

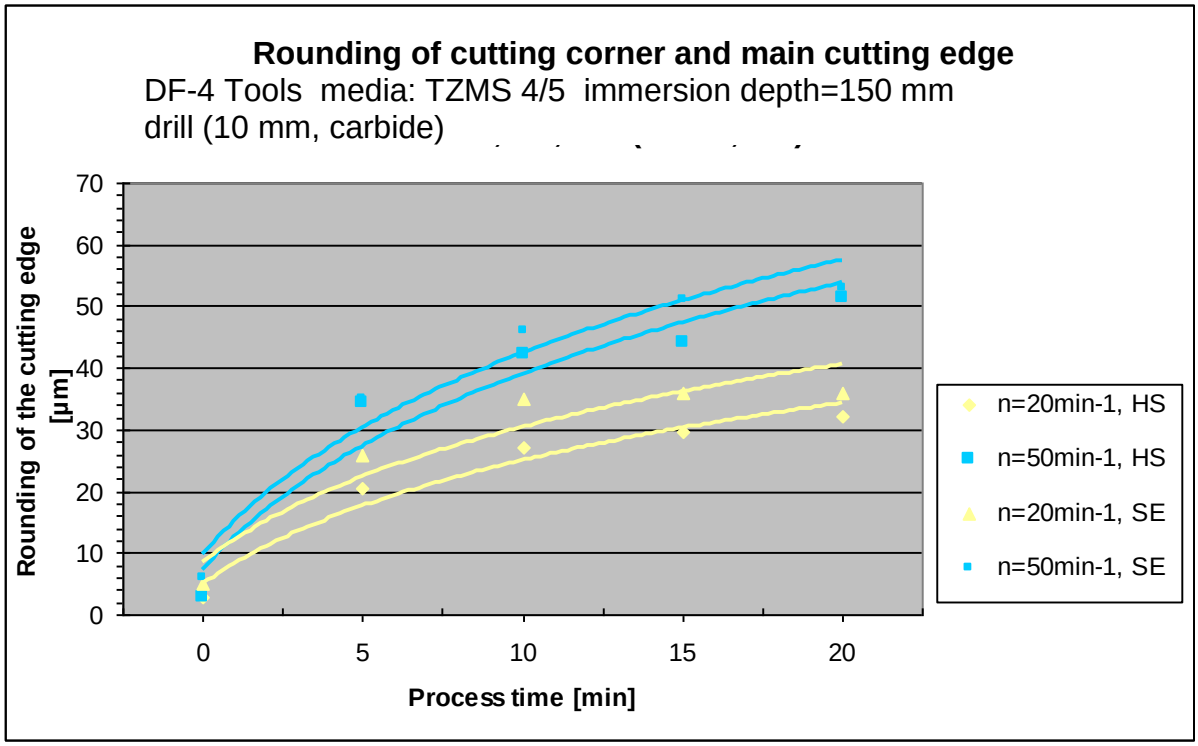
3.1 Rounding of the main cutting edge and -corner



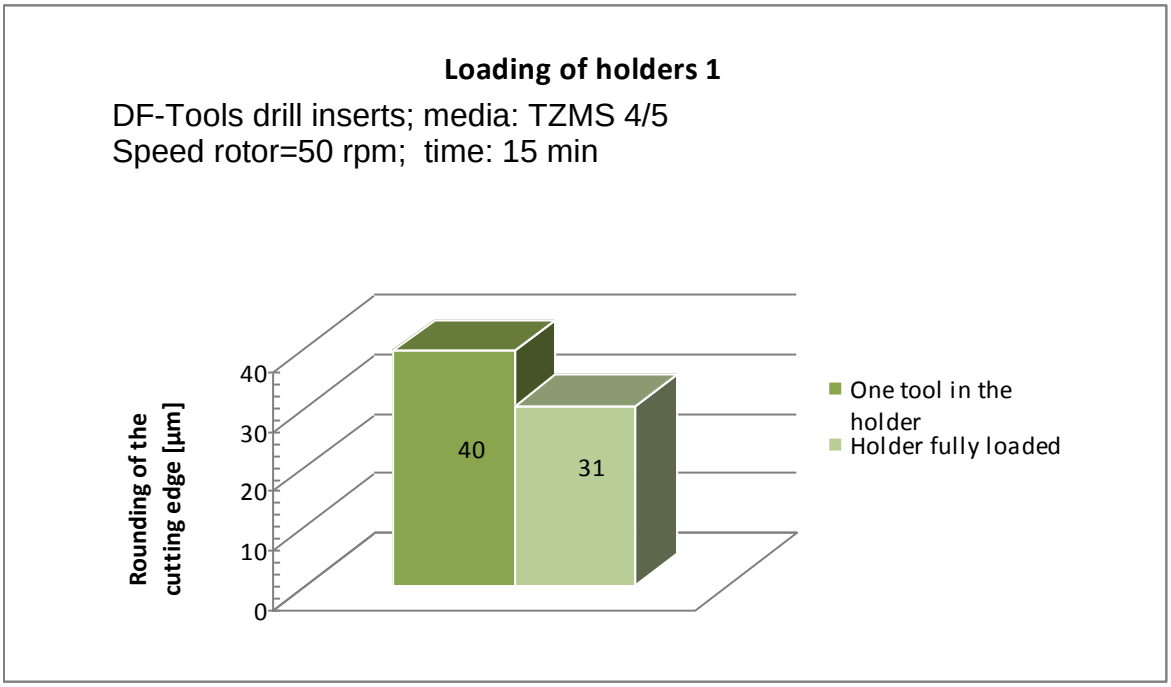
3.2 Speed



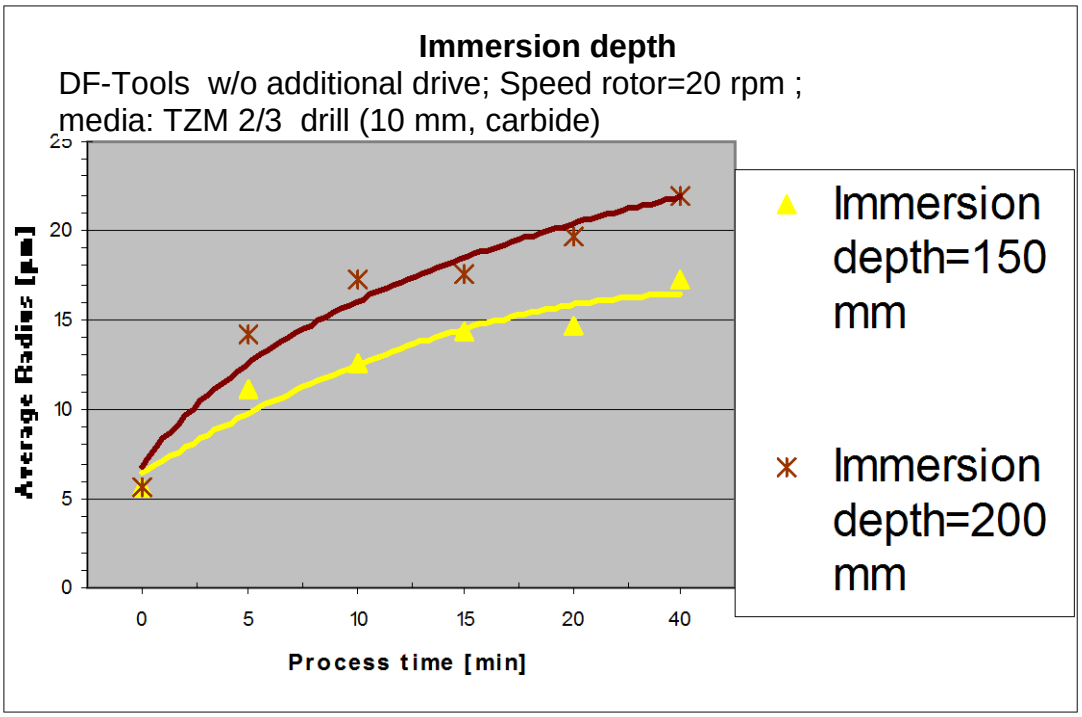
HS….main cutting edge


Rounding of cutting corner and main cutting edge
DF-4 Tools media: TZMS 4/5 immersion depth=150 mm
drill (10 mm, carbide)
Rounding of the cutting edge [µm]
70
60
50
40
30
20
10
0
0
5
10
15
20
Process time [min]
n=20min-1, HS
n=50min-1, HS
n=20min-1, SE
n=50min-1, SE

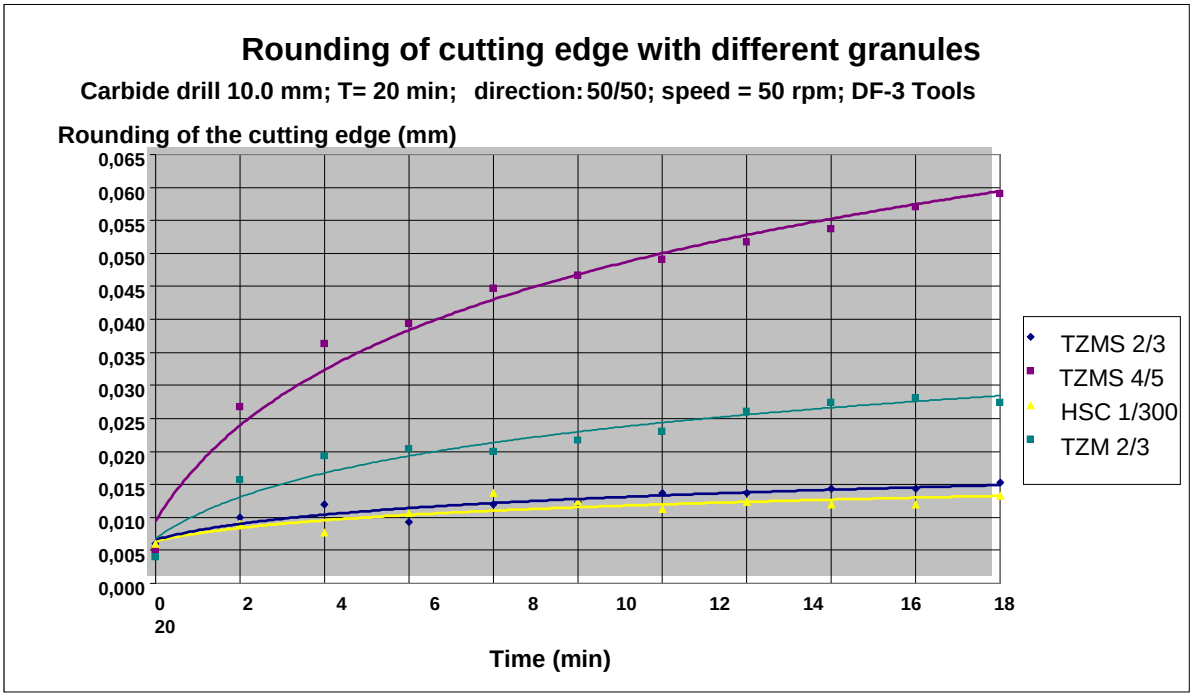
3.3 Amount of mountings



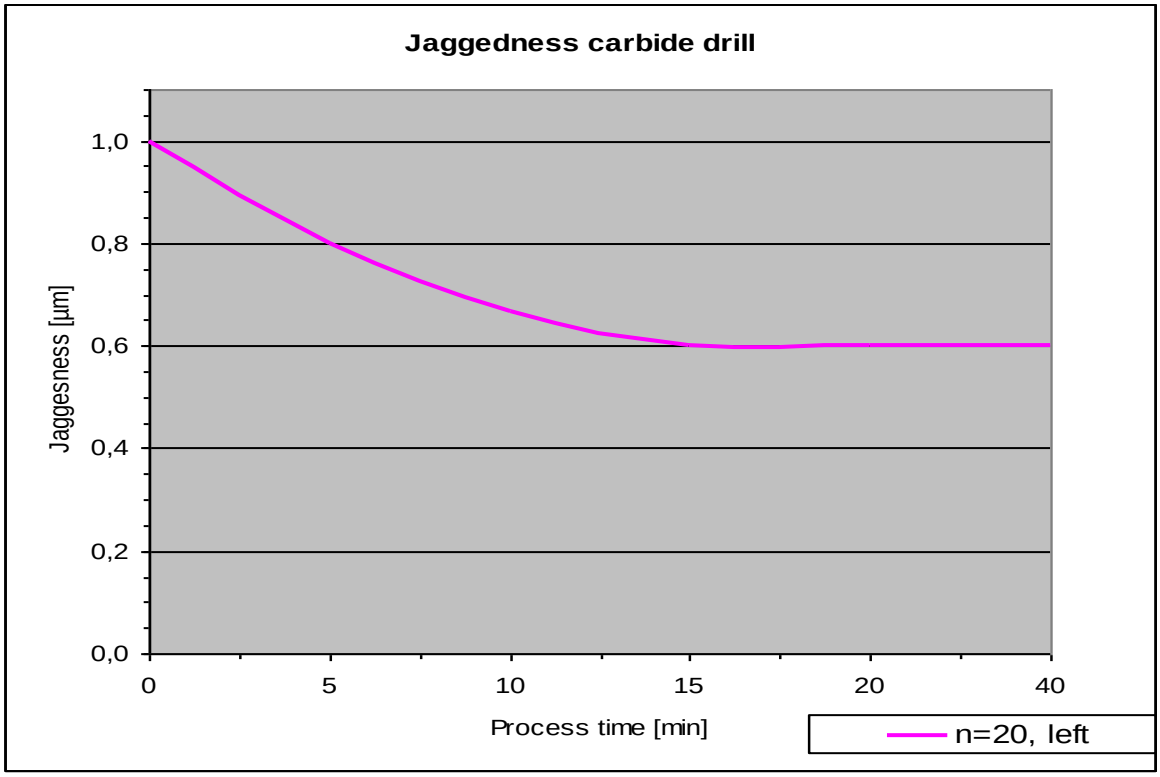
3.4 Immersion depth



3.5 Rounding of the cutting edge with different granules



3.6 Jaggedness



3.7 Example Processing

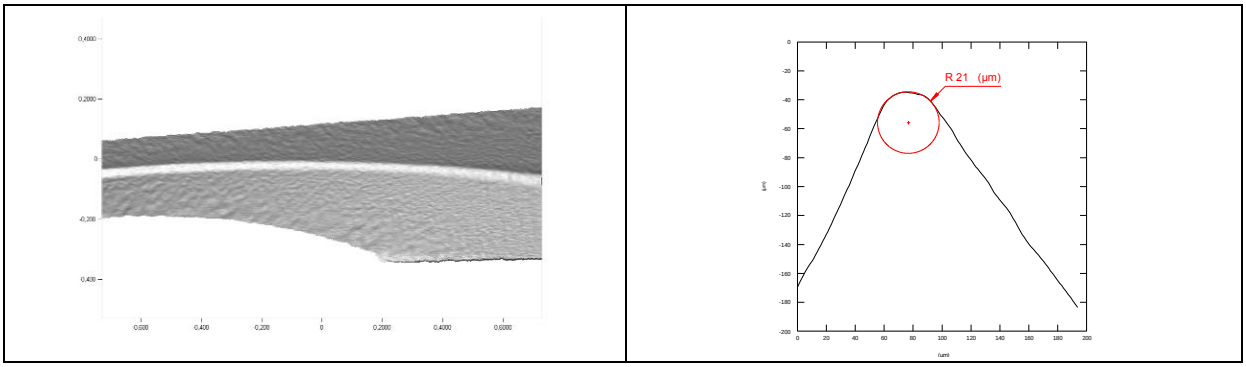
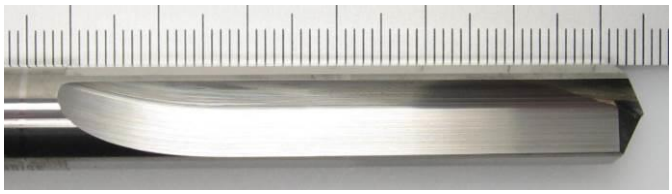


Figure 1: Drill, 8mm, cutting edge 21µm, before processing

3.8 Polishing straight fluted drills

Process time for polishing is around 15 to 30min.



Media: H4/400
Machine DF-3 Tools with angled holders

				Sense of direction		Immersion depth [mm]	Direction	
Tool	Time [min]	Speed Rotor [rpm]	Speed holders [rpm]	Normal	Counter		Left	Right
10 mm	15	45	10	x		max	100%	