

Processing of Carbide End Mills



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Processing of carbide end mills

Processing of End Mills (HM)



When rounding the cutting edges of end mills, the following needs to be considered:

- Rounding of the cutting edge should not be larger than 30 μm , except of ball nose end mills
- 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 a maximum of 16 μm at carbide end mills can be achieved. The cutting corner of the tool will not be rounded significantly more.
- Using HSC 4/400 or M4/300 for carbide tools, a cutting edge of 10 μm can be achieved during polishing (max. 20 minutes).
- Processing the tool in just cutting direction, a k-factor of larger than 1 can be achieved.
- The actual process time depends on the carbide grade (fine grain needs probably a longer process time) as well as on the amount of cutting edges. Generally the process time is the most reasonable parameter to achieve larger or smaller rounding. For sure also the choice of processing media is mayor important.
- The influence of the process parameters for rounding and jaggedness can be described as follows:

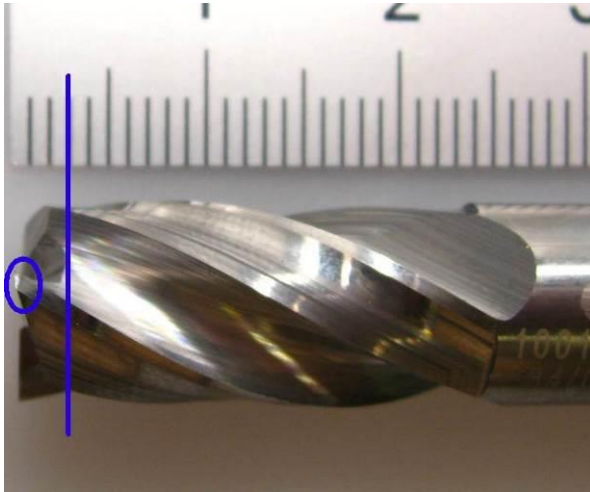
Rounding:

- Process time: ca. 40%
- Speed rotor: ca. 30%
- Speed holder: ca. 20%
- Sense of direction: 10% (into cutting direction: more rounding)

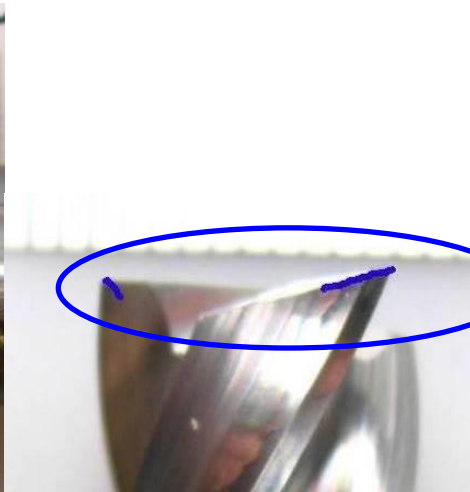
Jaggedness:

- Process time: ca. 15%
- Speed rotor: ca. 5%
- Speed holder: ca. 15%
- Sense of direction: 23% (against cutting direction: smoother)

Processing of carbide end mills



Measuring point at the main cutting edge



Measuring point at the cutting corner

Processing of carbide end mills

1. Job Definition

Rounding of the cutting edges to 6 μm – 30 μm

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

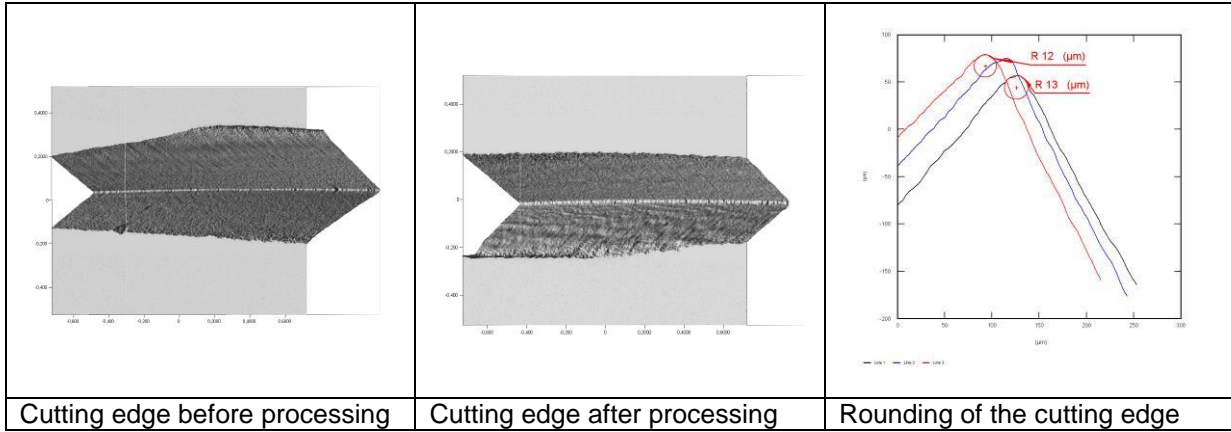
- Processing of wood: 4 to 6 μm
- Processing of aluminium/Titanium 6 to 8 μm
- Processing of steel 10 to 25 μm
- Processing of ball nose end mills to 30 μm

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 holder [min-1]	Direction of rotor	Time (min.)	Holders angled Yes/No	Immersion depth
End mill	5	4,3	29,8	TZM 2/3	40	20	50%-50%	4	N	Max.
End mill	5	6	12	HSC 1/300	45	96	50%-50%	8	N	Max.
End mill	7	1,2	8	HSC 1/300	45	96	50%-50%	3	N	Max.
End mill	7	3,5	10,8	HSC 1/300	45	96	50%-50%	5	N	Max.
End mill	7	2,9	14,8	HSC 1/300	45	96	50%-50%	12	N	Max.
End mill	8	3,9	12	TZM 2/3	45	96	50%-50%	1	N	Max.
End mill	10	6	15,4	HSC 1/300	45	96	50%-50%	12	N	Max.
End mill	10	2,5	21,8	TZM 4/5	45	20	50%-50%	4	N	Max.
End mill	10	2,4	26,9	TZM 4/5	45	20	50%-50%	6	N	Max.
End mill	12	3,7	15,8	HSC 1/300	45	96	50%-50%	12	N	Max.
End mill	20	3,9	14,9	HSC 1/300	45	96	50%-50%	12	N	Max.
End mill	20	5,7	27,9	TZM 4/5	45	20	50%-50%	7	N	Max.
End mill	10		8,9	H4/400	45	20	50%-50%	15	Y	Max.
Droplet removal at end mill				HSC 1/300	45	96	30 sec right, 120 sec left	2,5	N	Max.

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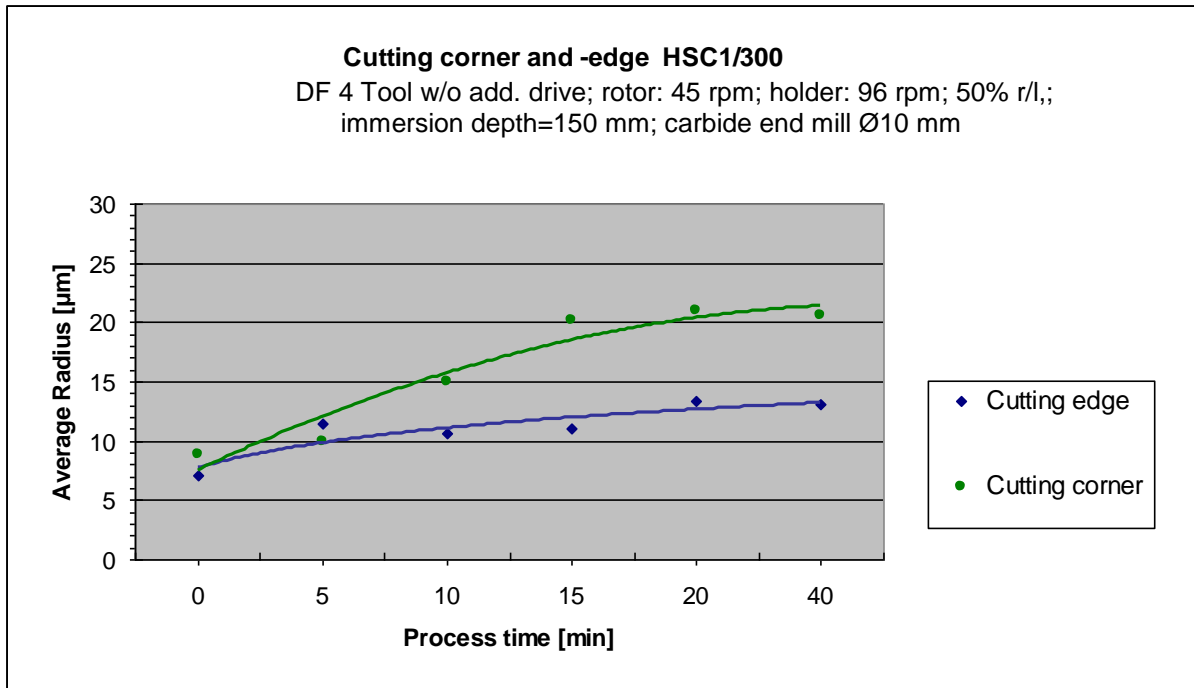
Measuring the cutting edge



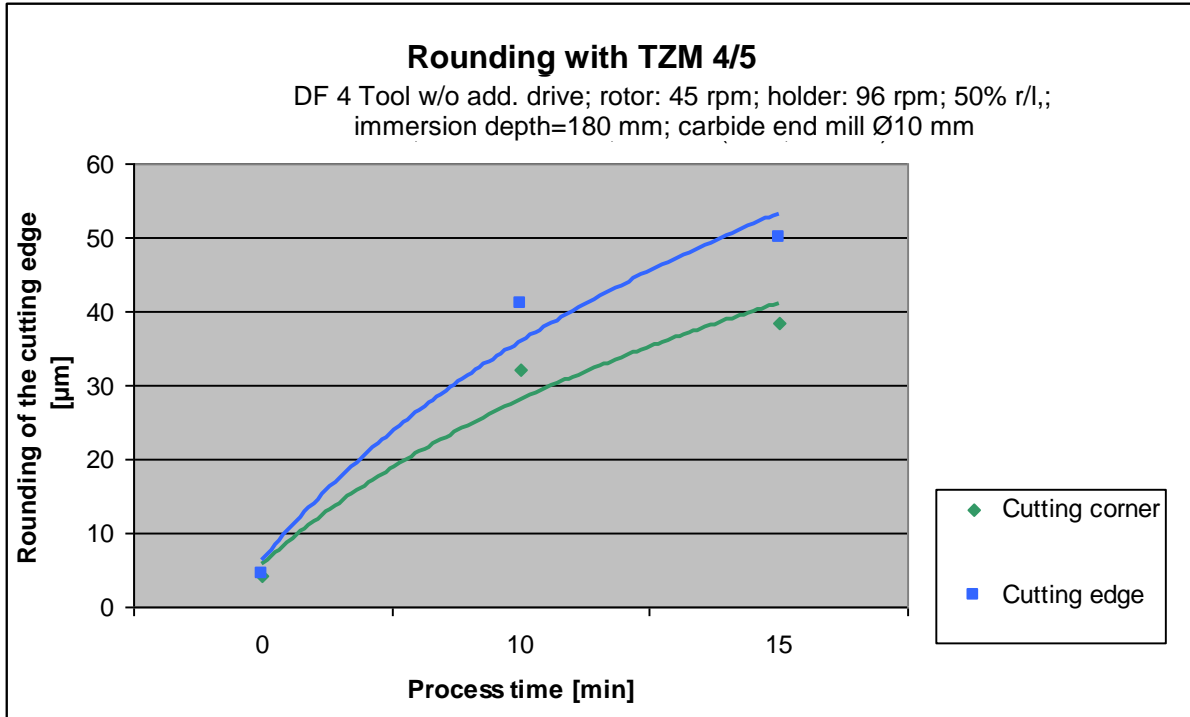
Processing of carbide end mills

3. Some charts

3.1. Comparison cutting edge – cutting corner at different speed

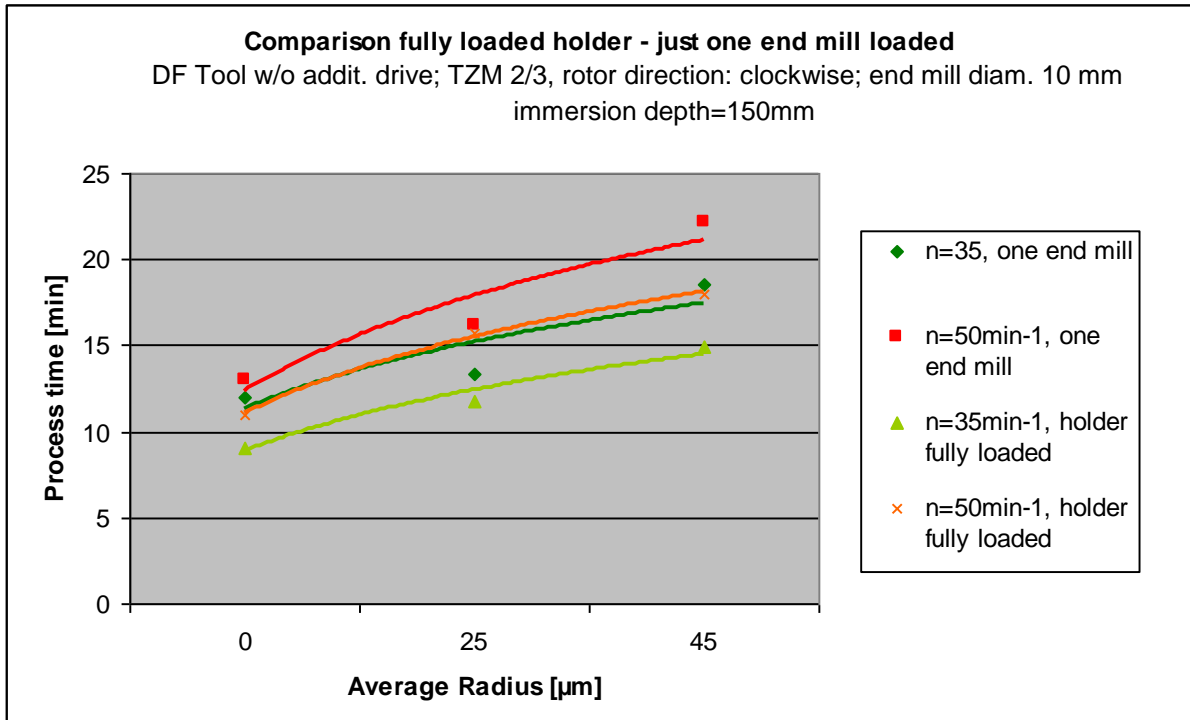


Processing of carbide end mills



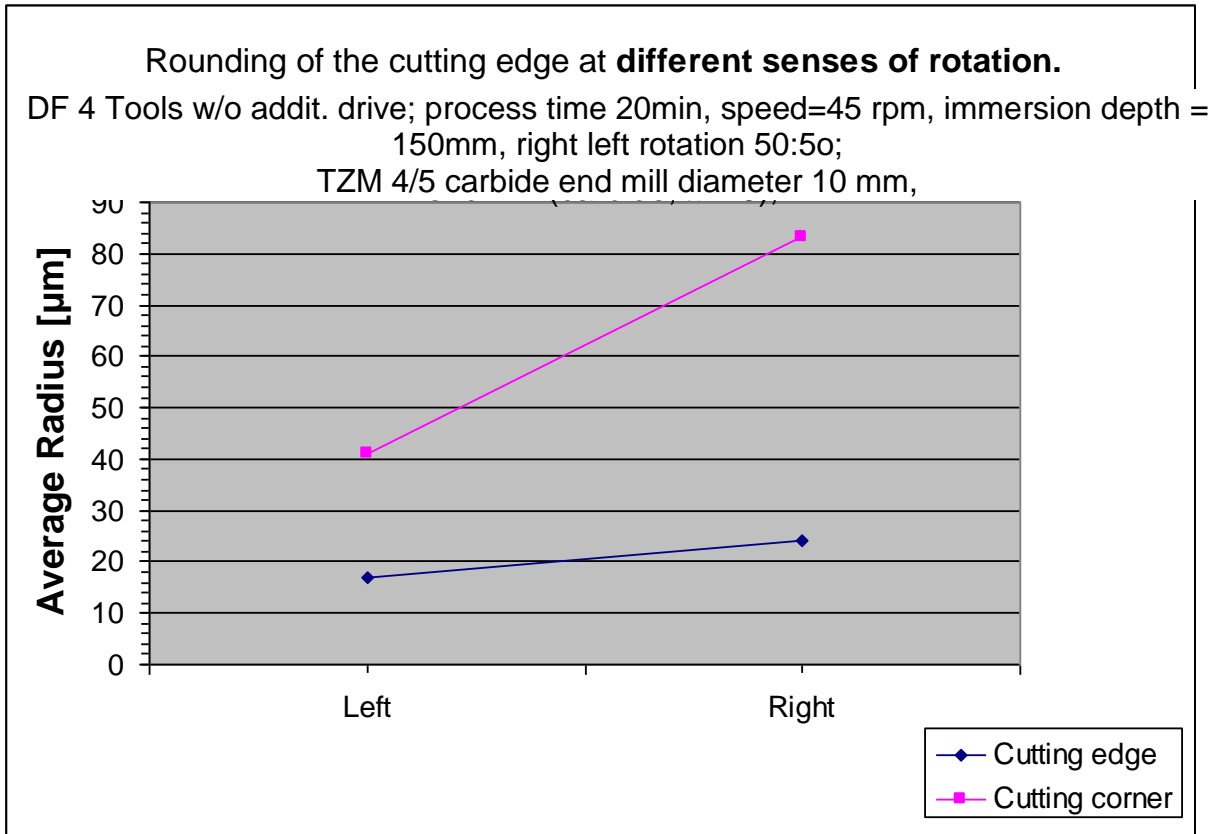
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3.2.Amount of mountings



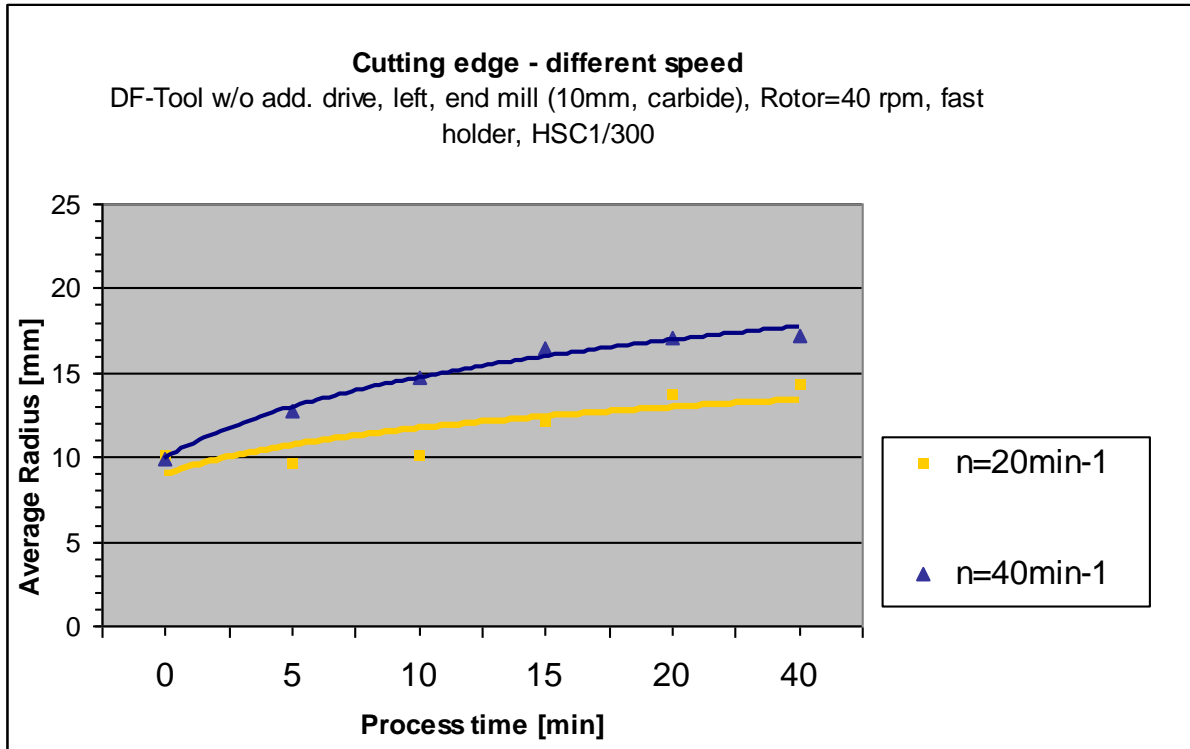
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3.3. Different directions



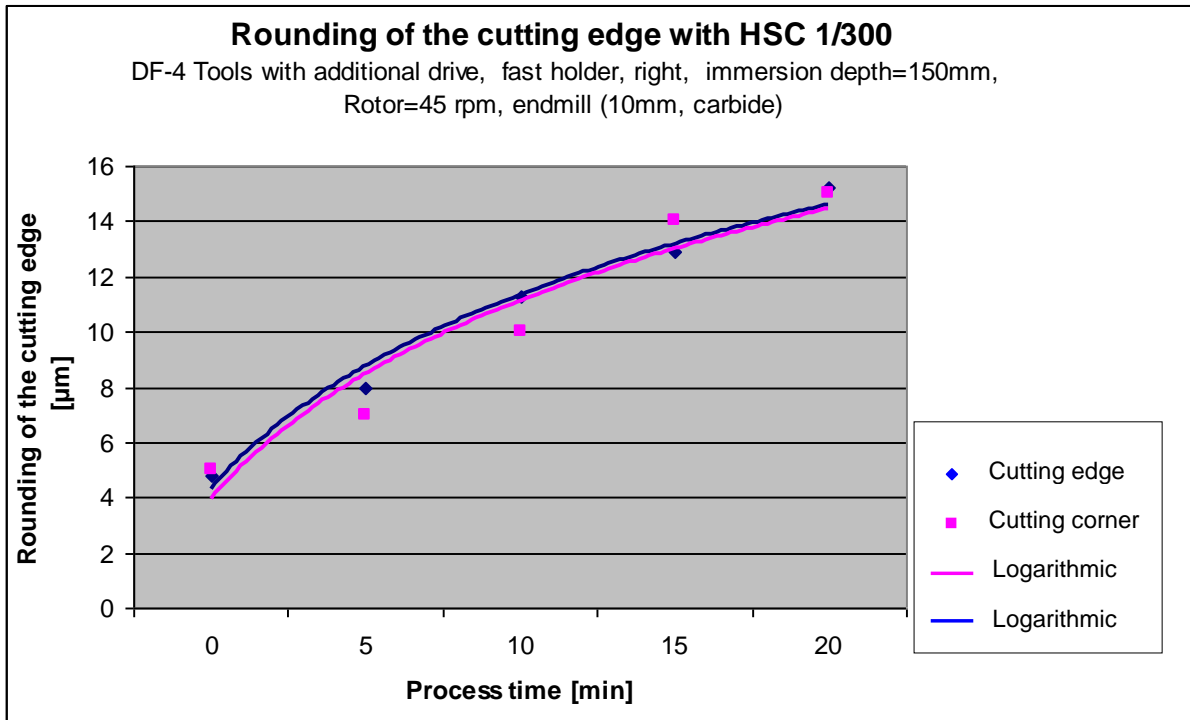
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3.4. Rounding of the cutting edge with different speed



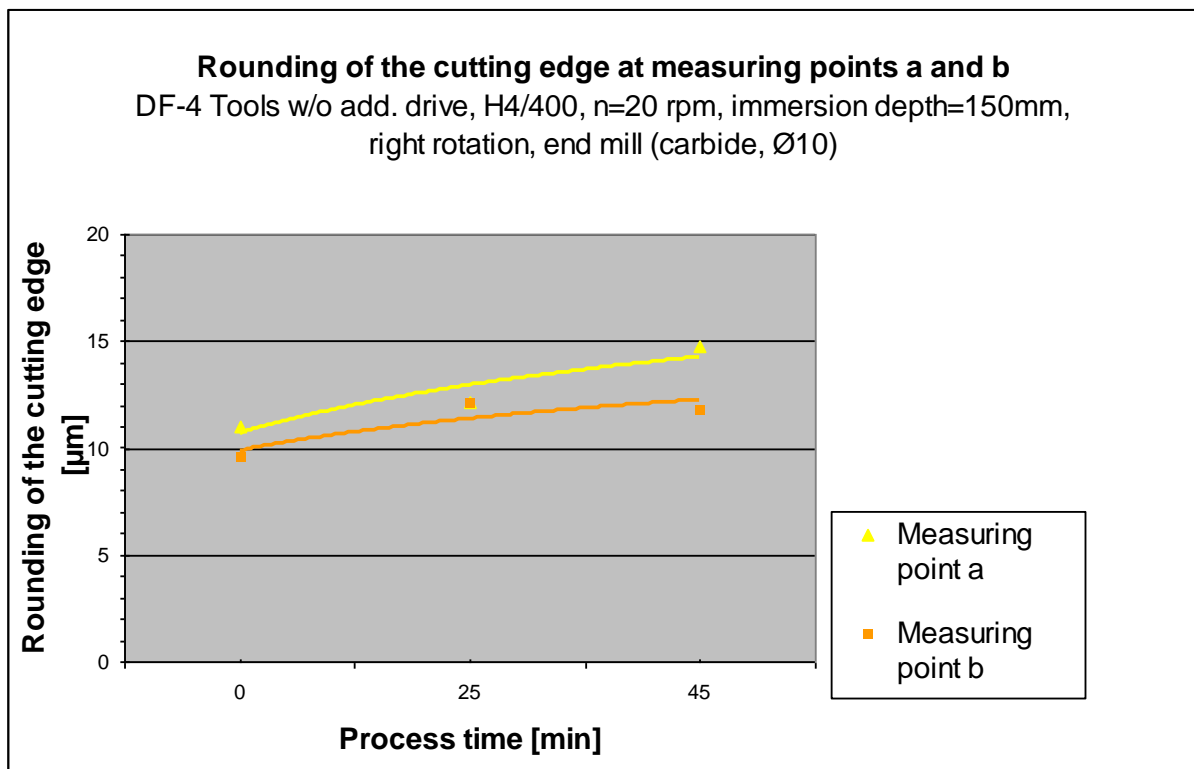
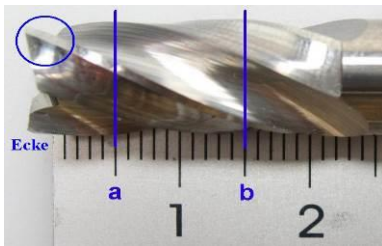
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3.5. Rounding of the cutting edge with HSC1/300

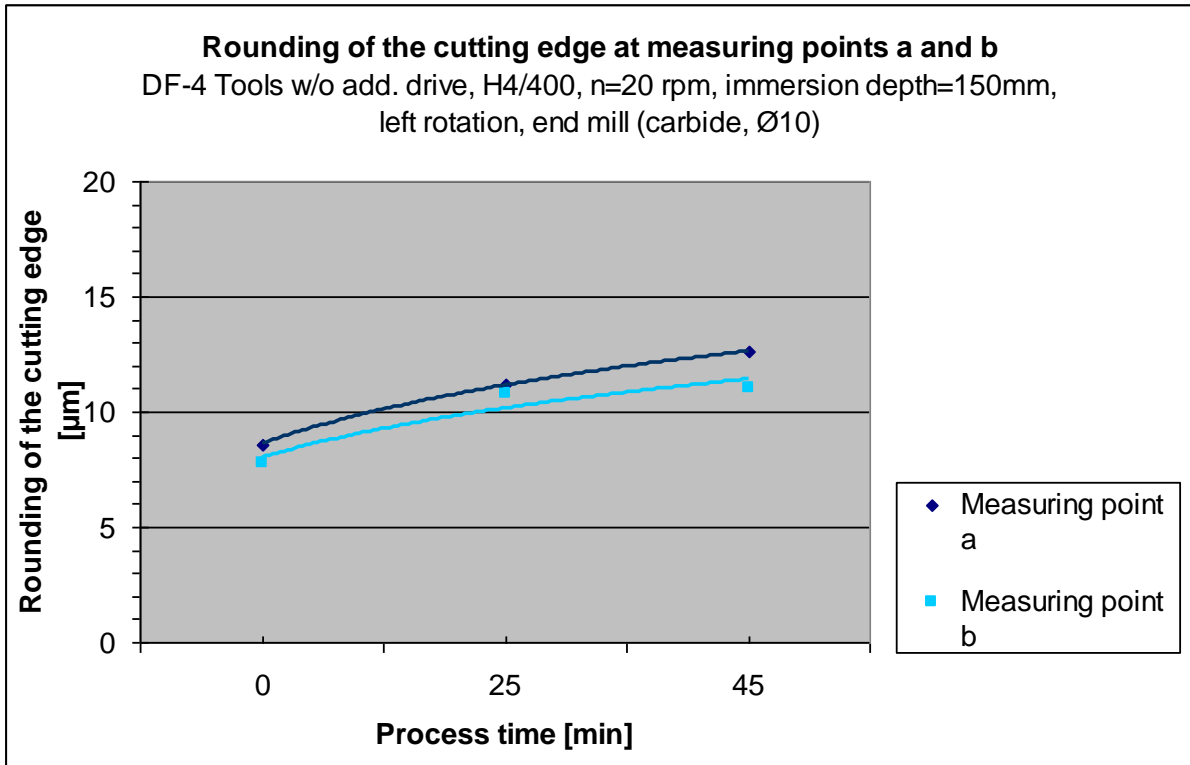


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3.6. Different measuring points at the cutting edge in relation to the sense of rotation

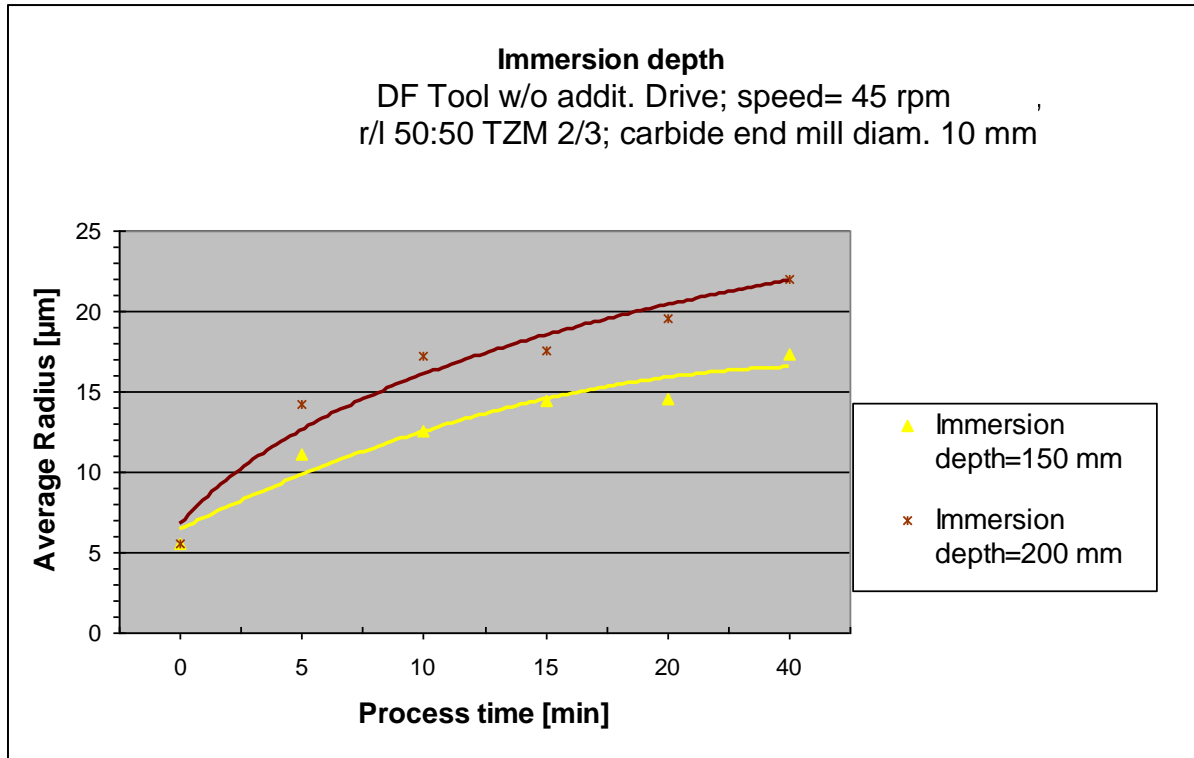


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Processing of carbide end mills

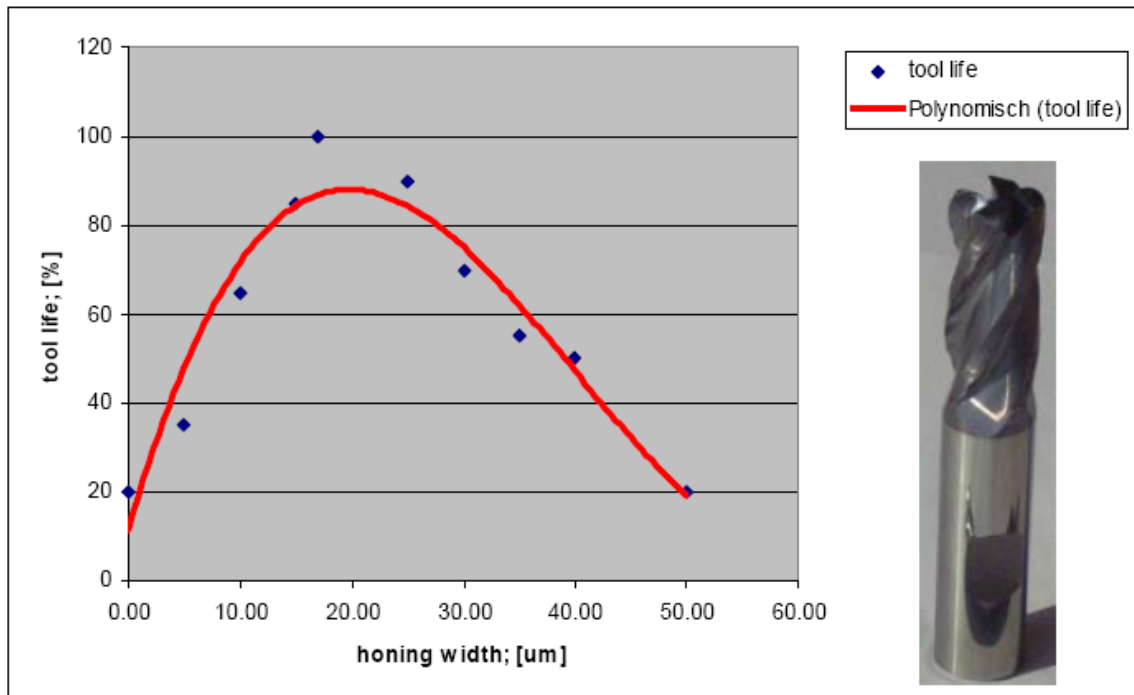
3.7. Immersion depths



Processing of carbide end mills

3.8. Increased tool life in relation to cutting edge preparation

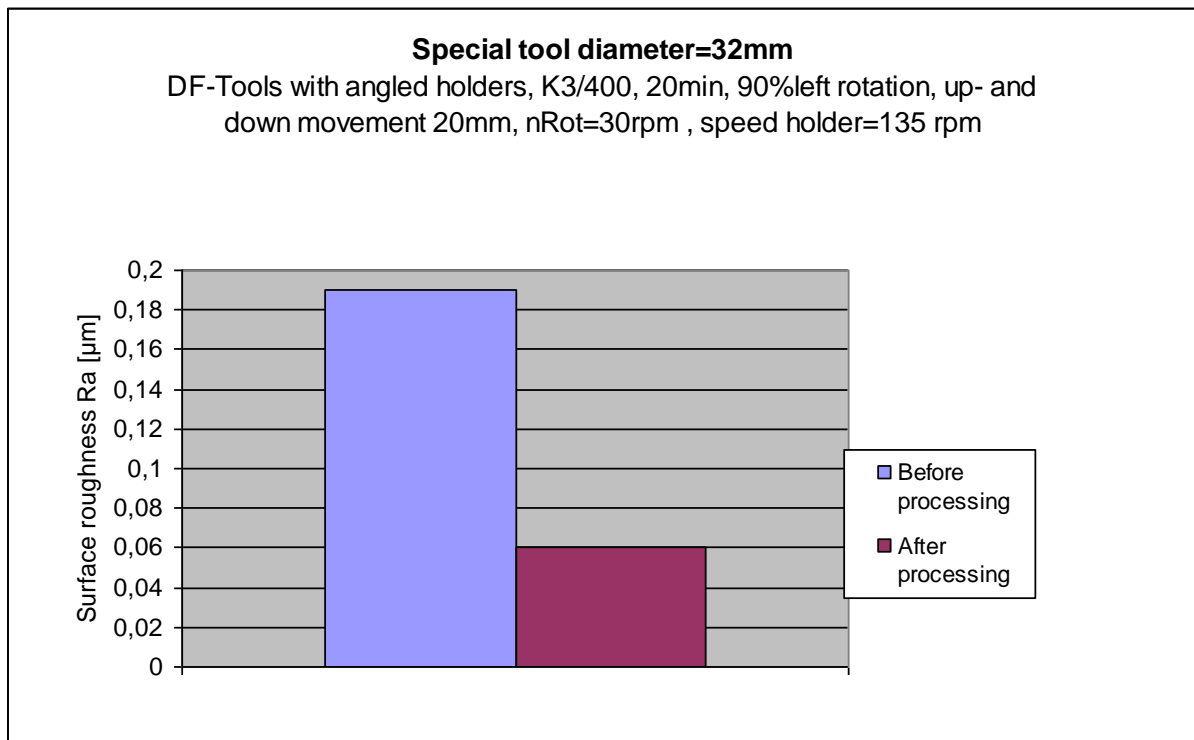
Influence of the Edge Preperation on Tool Life
at High Performance Torus End Mill in **HIGH ALLOYED** Steel



Material: 1.2379 - **X155CrVMo12-1**
End mill: nACRo coated - d=10mm, z=4, ae=0.25 x d – ap=1.5 x d – vc=150 m/min – fz=0.05 mm/z

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3.9. Smoothing of the flute (meanwhile K3/400 was replaced by H4/400)



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3.10. Jaggedness at the cutting edge (Media: HSC 1/300)

