



Desgaste da ferramenta de corte

Escolas STEM4inclusivas
WP2 – Caixa de ferramentas

-1-



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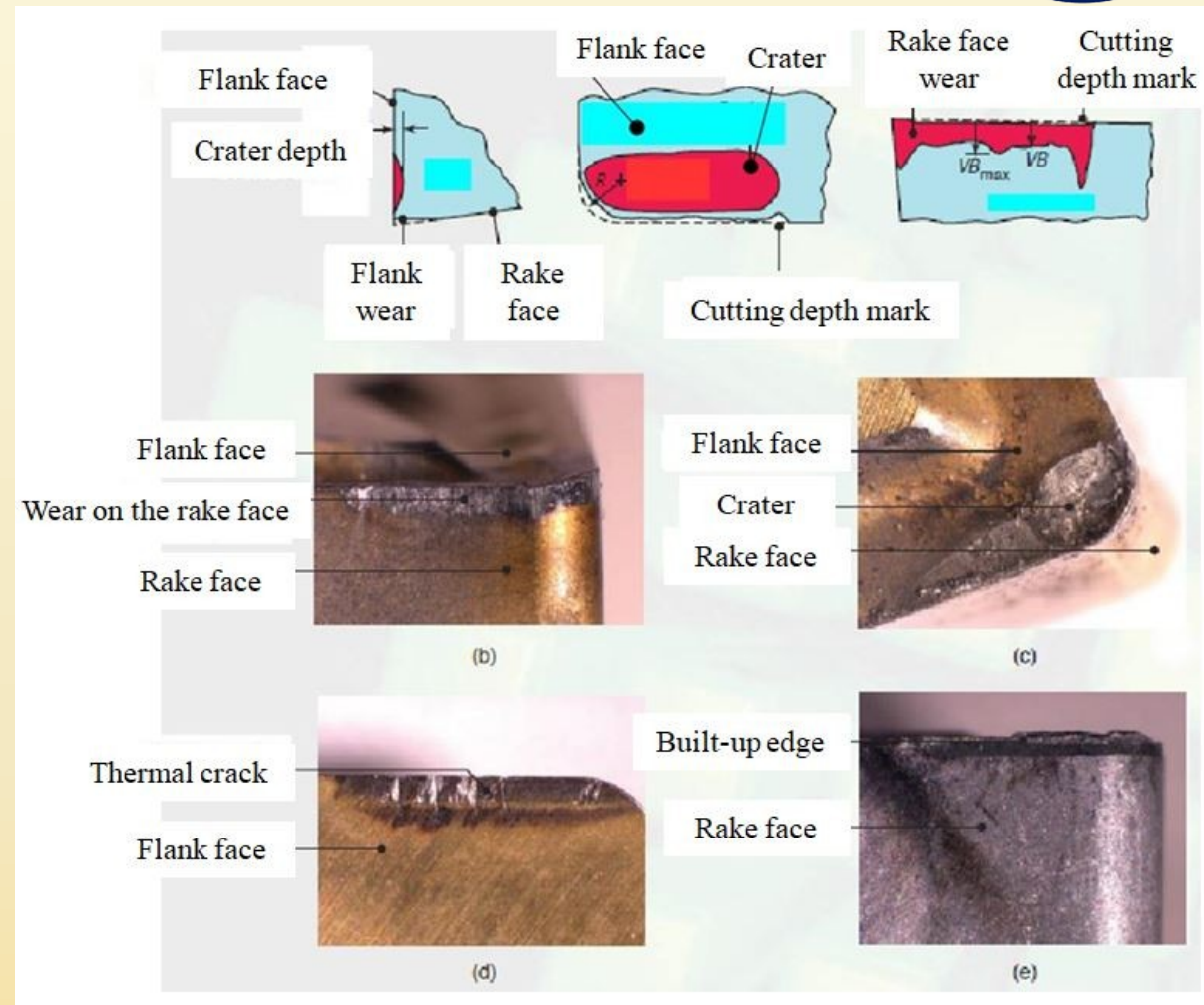
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Tipos de desgaste

- a) desgaste na face do assento;
- b) desgaste de cratera;
- c) desgaste por pites;
- d) fissuras por estresse térmico;
- e) depósitos de borda;
- f) desgaste catastrófico.

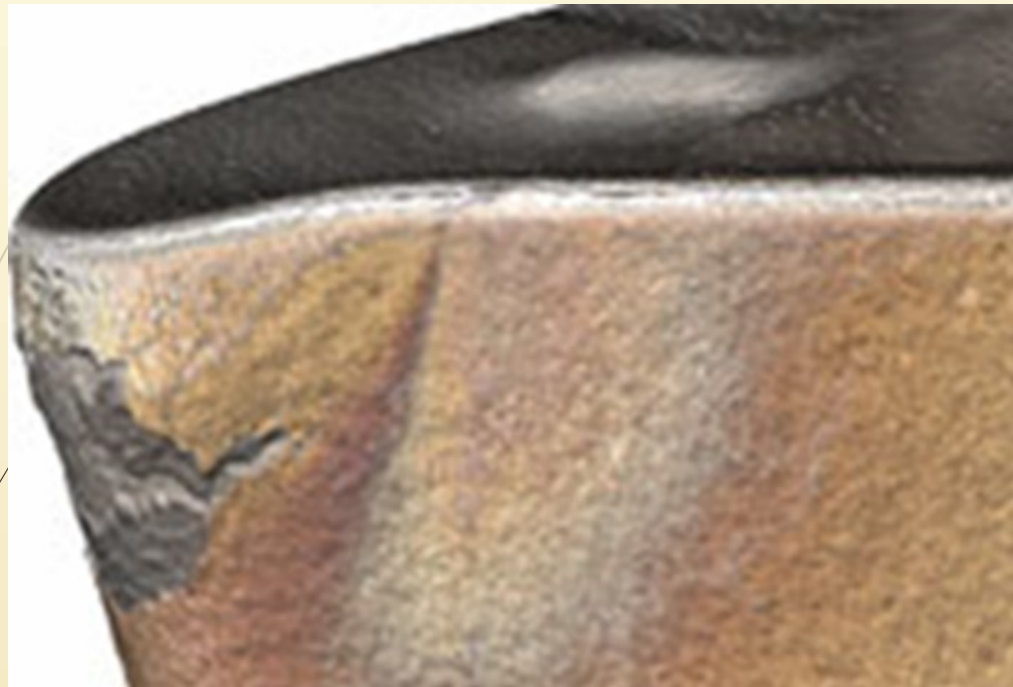
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Tipos de desgaste



Tipos de desgaste



-4-



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Equação de Taylor

$$VT^n = C$$

Material da ferramenta	O expoente n
HSS	0,08 – 0,2
Ligas de fundição	0,1 – 0,15
Carbonetos metálicos	0,2 – 0,05
Materiais mineral-cerâmicos	0,5 - 0,7



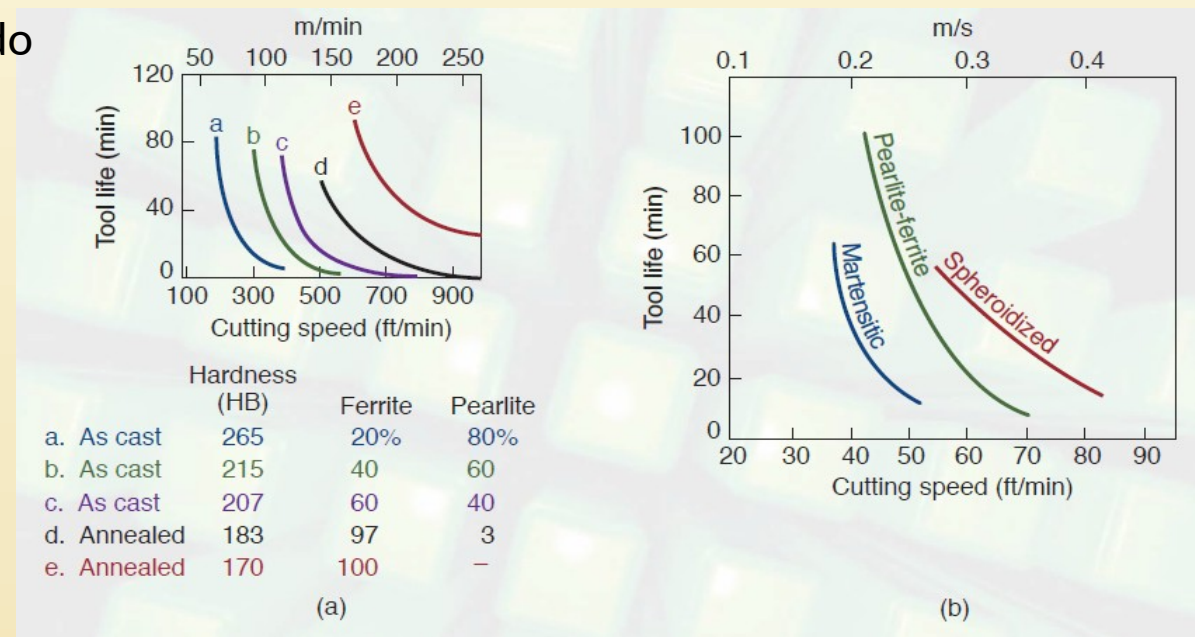


Efeito do material em branco na durabilidade

Efeito da microestrutura do blank na durabilidade da ferramenta, no torneamento.

A durabilidade é dada pelo tempo (em minutos) necessário para atingir um desgaste de flanco de um determinado tamanho.

- a) ferro fundido;
- b) aço.



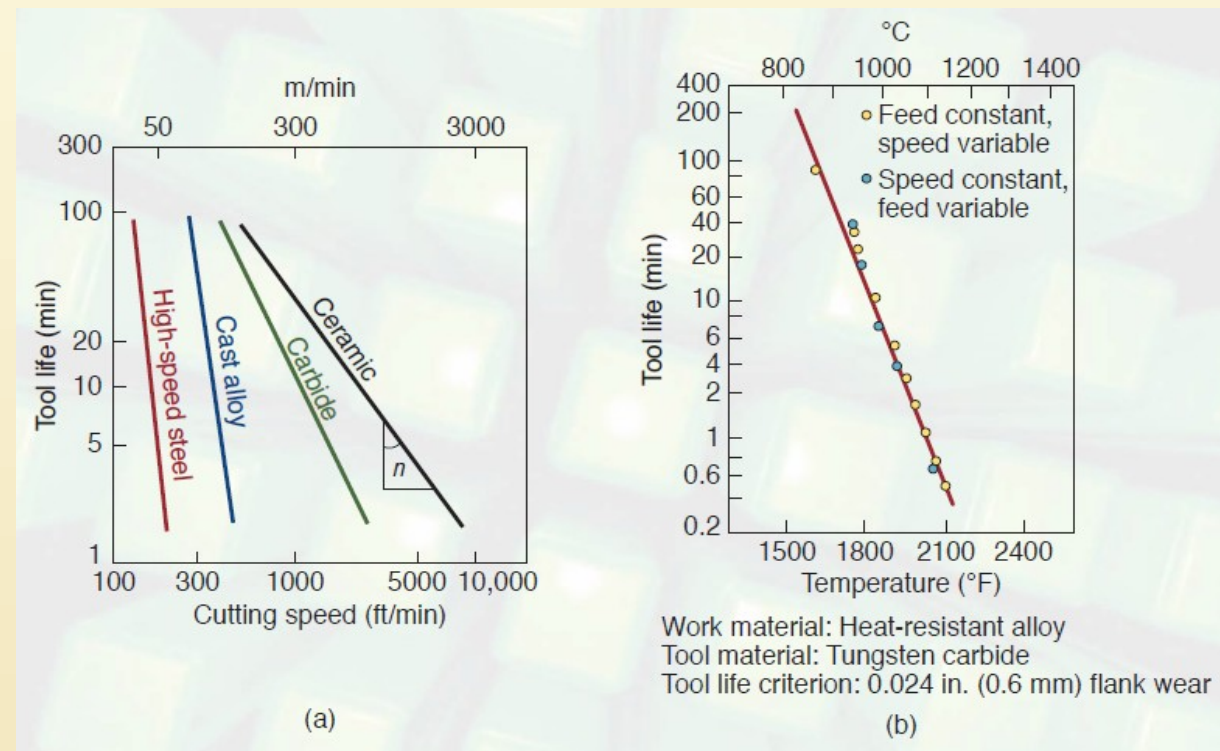
Monitoramento de desgaste de ferramentas para fresamento por meio do rastreamento de coeficientes do modelo de força de corte}, Yanjun Cui, 2008, url <https://api.semanticscholar.org/CorpusID:113926195>





Tabelas de durabilidade

- a). Diagramas de durabilidade para vários materiais.
A inclinação da curva corresponde ao expoente de durabilidade n .
- b). Relações entre a temperatura medida durante o corte e a durabilidade da ferramenta (para desgaste de flanco).

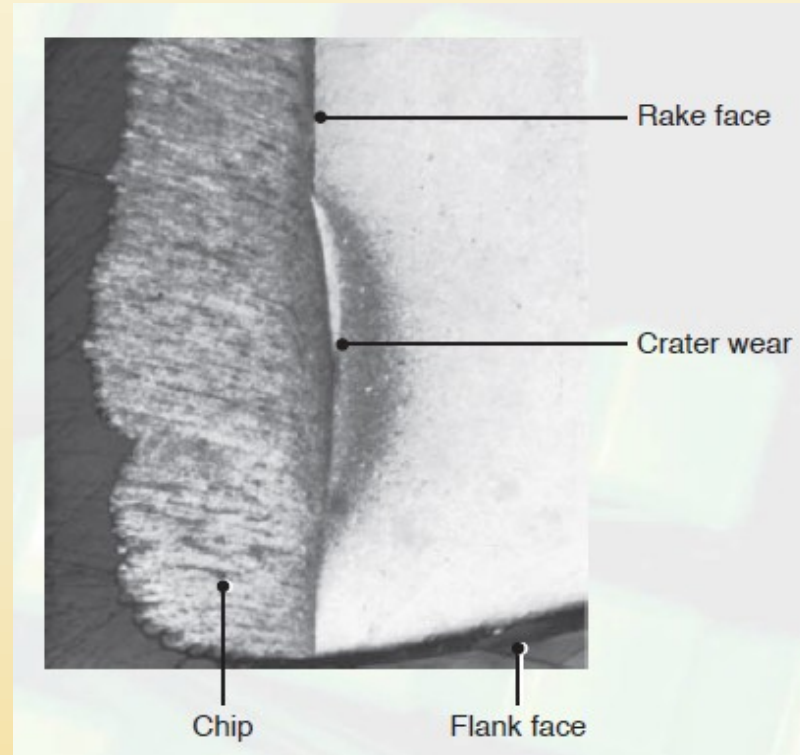


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Interfața între așchie (stânga) și fața de degajare a sculei (dreapta), și uzura tip crater la așchiera unui otel AISI 1040 com velocidade de 3 m/s.
Schimbarea culorii sculei indica temperatura alta. A observação coincide com a forma de crateras e apresenta modificações de cores.

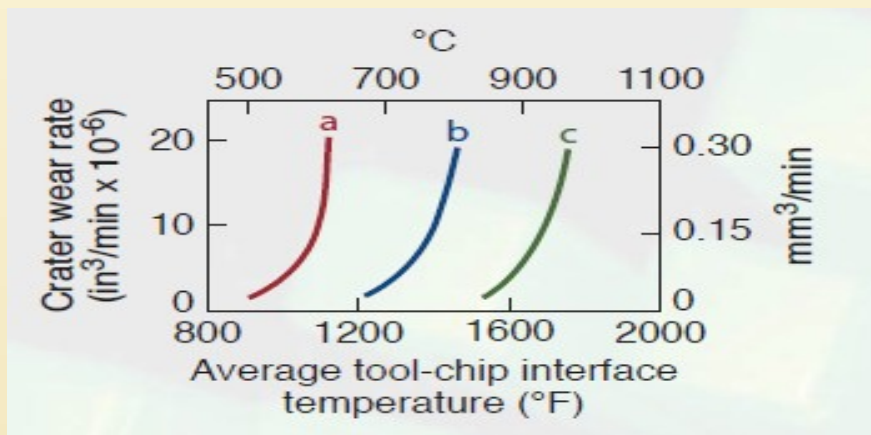




Relação entre desgaste de cratera e temperatura média na interface ferramenta-peça, no caso de torneamento:

- a) ferramenta de aço rápido;
- b). Carboneto C1;
- c). Carboneto C5.

Observe o rápido aumento do desgaste em uma faixa estreita de temperatura.



-9-

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Desgaste admissível [mm]		
O processo	Oçel rápido	Carburi
Girando	1,5	0,4
Fresamento periférico	1,5	0,4
Fresagem frontal	0,3	0,3
Perfuração	0,4	0,4
Alargamento	0,15	0,15



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Relação entre desgaste médio na face de assentamento, desgaste máximo da cratera e emissão acústica, em função do tempo de usinagem. A técnica é desenvolvida como meio de monitorar o desgaste em diversos processos de corte (método contínuo e indireto).

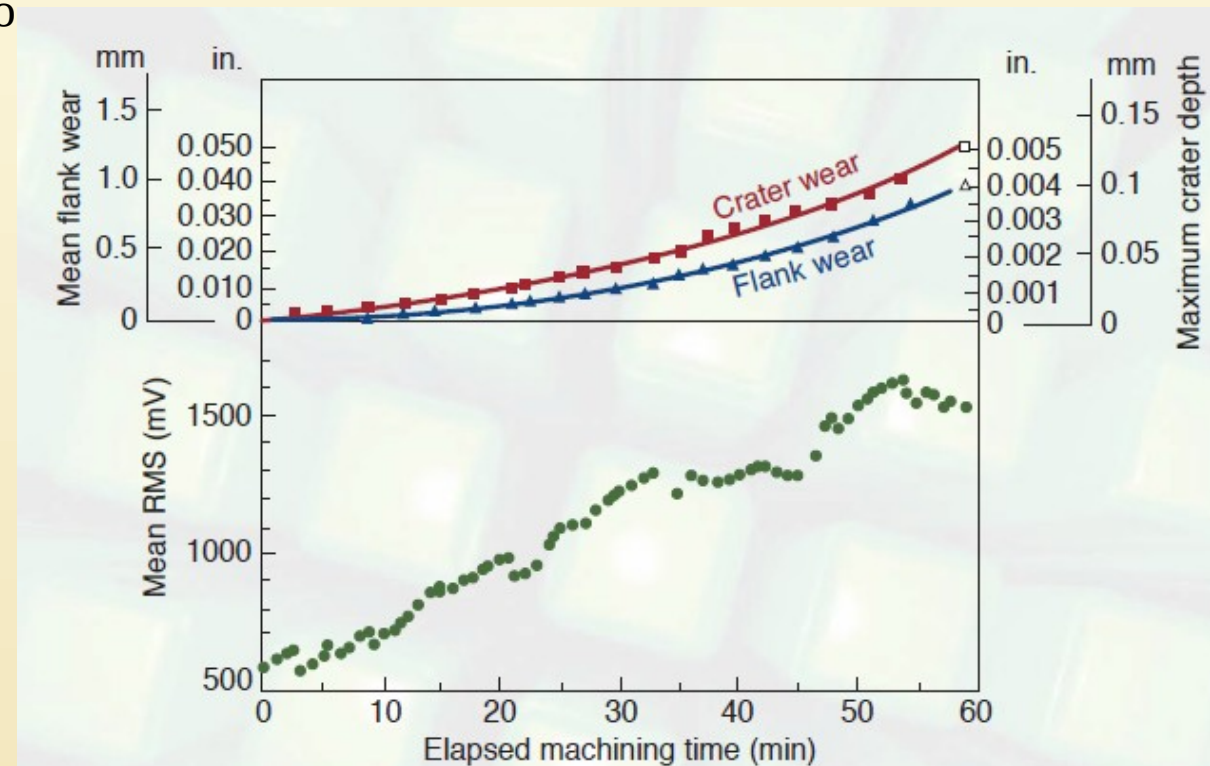
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Mecanismos de desgaste

Desgaste abrasivo

Ela ocorre nas áreas de contato entre o cavaco e a face de folga da ferramenta, respectivamente entre a superfície lascada e a face de assentamento da ferramenta, e é causada por partículas abrasivas duras (cementita ou carbonetos de alguns elementos de liga).

Ela se manifesta principalmente na forma de desgaste na face de assentamento ou na forma de cratera, na usinagem com ferramentas de aço carbono.





Mecanismos de desgaste

Desgaste adesivo

Ela é causada pela adesão molecular de alguns constituintes do material do cavaco ao material da ferramenta (por exemplo, adesão entre ferrita no material da peça de trabalho e cobalto no material da ferramenta).

-12-



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Mecanismos de desgaste

Desgaste de difusão

Ocorre como resultado da difusão de alguns elementos do material da ferramenta para a solução sólida do material a ser processado. Por exemplo, ao usinar com ferramentas de carboneto, o carbono do material da ferramenta, sob a ação de altas temperaturas e pressões, migra para o material do cavaco.





Mecanismos de desgaste

Desgaste de transporte iônico

O material da ferramenta e a peça de trabalho formam um par galvânico. Nesse par, forma-se uma corrente iônica, com direção da ferramenta para a peça de trabalho. Através dessa corrente, a ferramenta perde íons e se desgasta.

-14-



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Mecanismos de desgaste

Desgaste por lascamento

Ocorre como resultado de estresse em ferramentas feitas de materiais frágeis (por exemplo, carbonetos).

-15-



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Critérios de desgaste

O momento de desgaste inaceitável da ferramenta de corte pode ser detectado por vários sinais:

- aparecimento de estrias brilhantes na superfície lascada.
- aumento da força de corte;
- alteração na forma e na cor do chip (aparecimento de cores de recuperação na superfície do chip);
- aumento da rugosidade da superfície lascada;
- aparecimento de vibrações no sistema tecnológico.





Critérios de desgaste

O desgaste de vários elementos da parte ativa da ferramenta é determinado de forma convencional. Por exemplo: $V_B = 0,2 \text{ mm}$, $K = 0,1$.

Desta forma, podem ser definidos os seguintes indicadores de usinabilidade:

$V_{60 B 0,2}$ – velocidade de corte na qual, após 60 minutos de corte contínuo, aparece um desgaste de V_B de 0,2 mm na superfície de assentamento da ferramenta, em condições normais de corte.

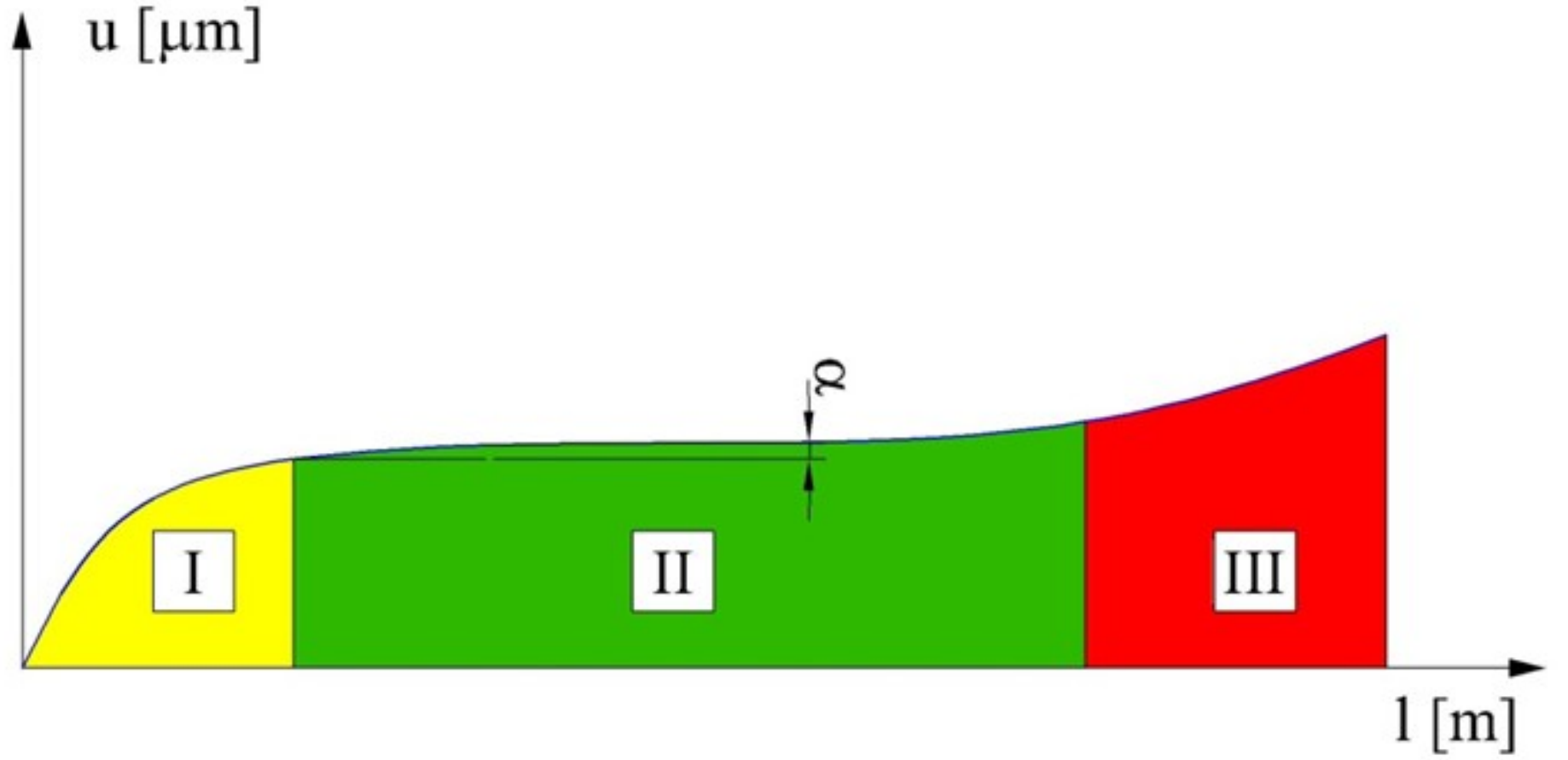
$V_{60 K 0,1}$ – velocidade de corte na qual, após 60 minutos de corte, é produzida uma cratera na superfície de folga, caracterizada pela relação $K=0,1$, em condições normais de corte.

V_{60} – velocidade de corte na qual, após 60 minutos de corte contínuo, em condições normais de trabalho, ocorre desgaste catastrófico.



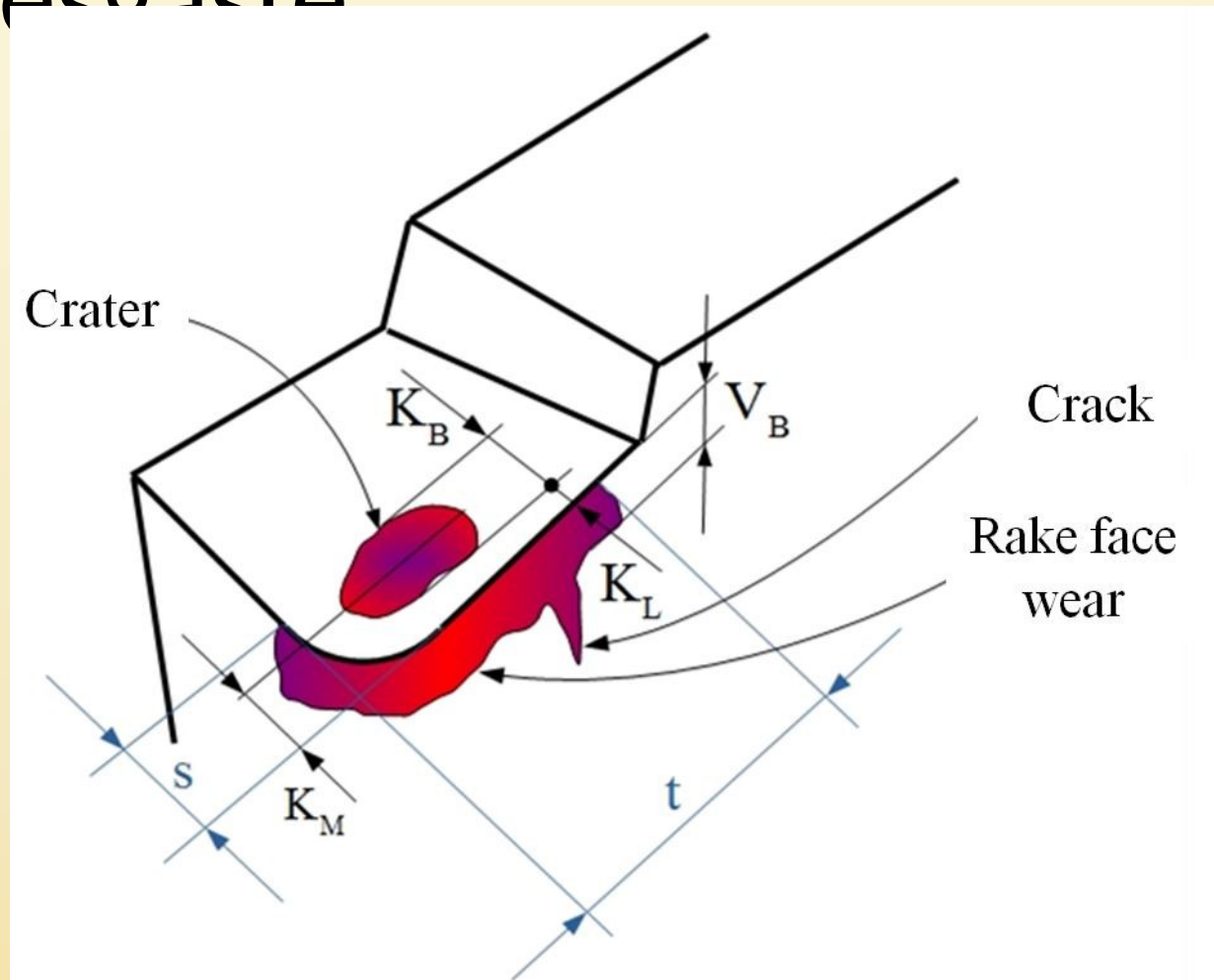


Analisando o desgaste da ferramenta de corte ao longo do tempo, três áreas principais podem ser distinguidas no dia





Valores admissíveis para parâmetros de critérios de desgaste





Tipos de desgaste



-20-



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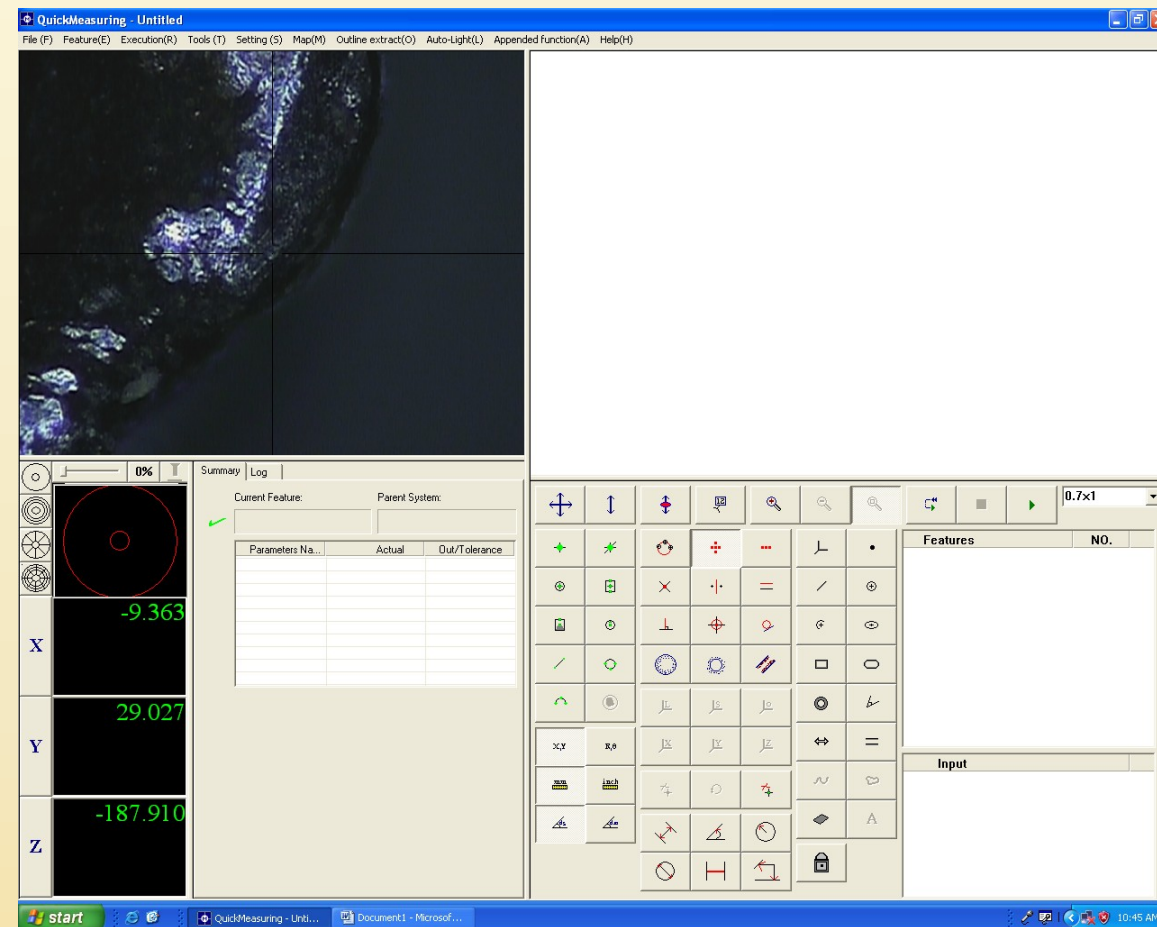
Tipos de desgaste



-21-

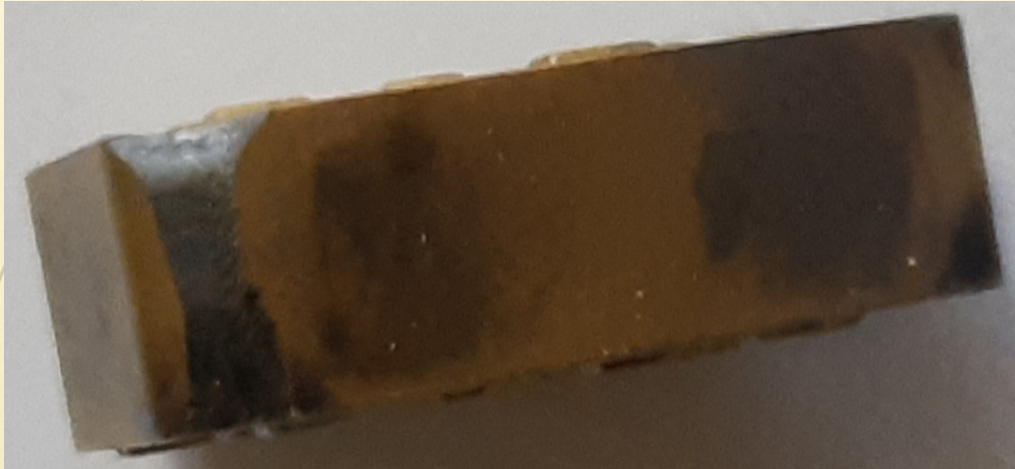


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-22-



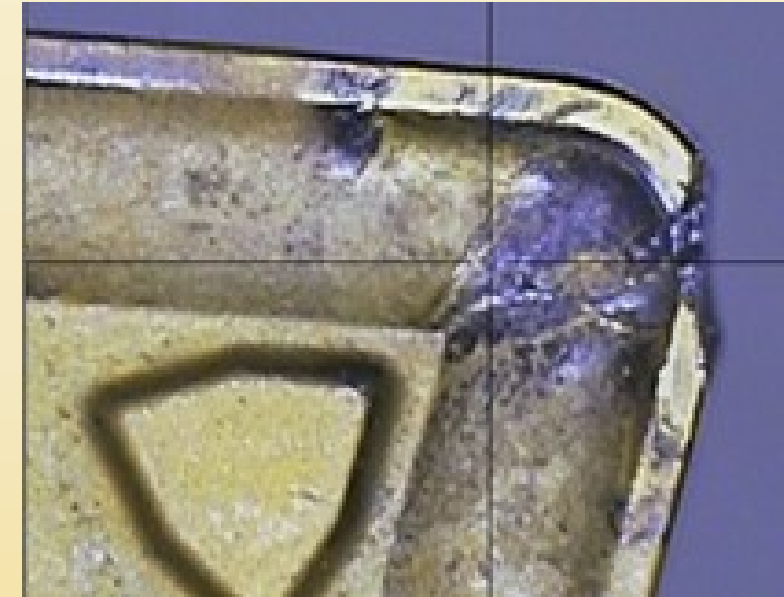
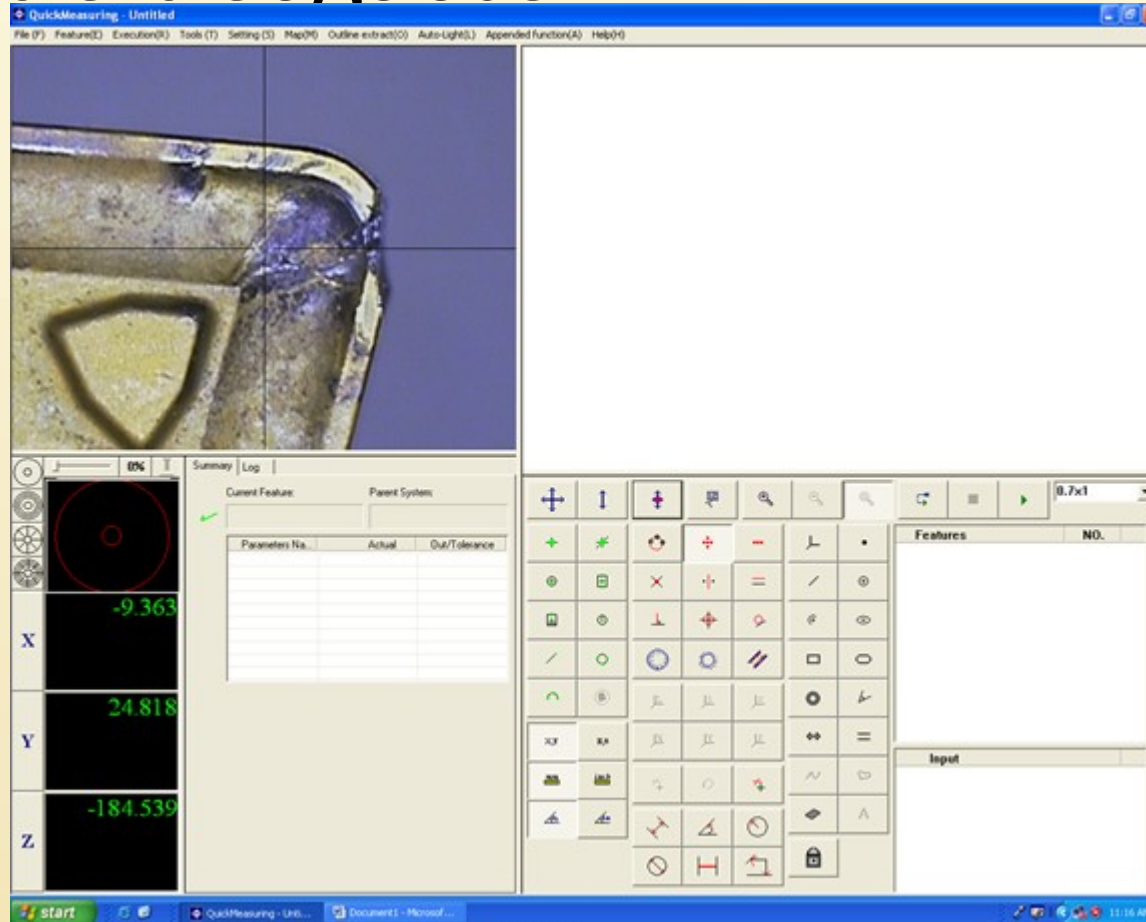
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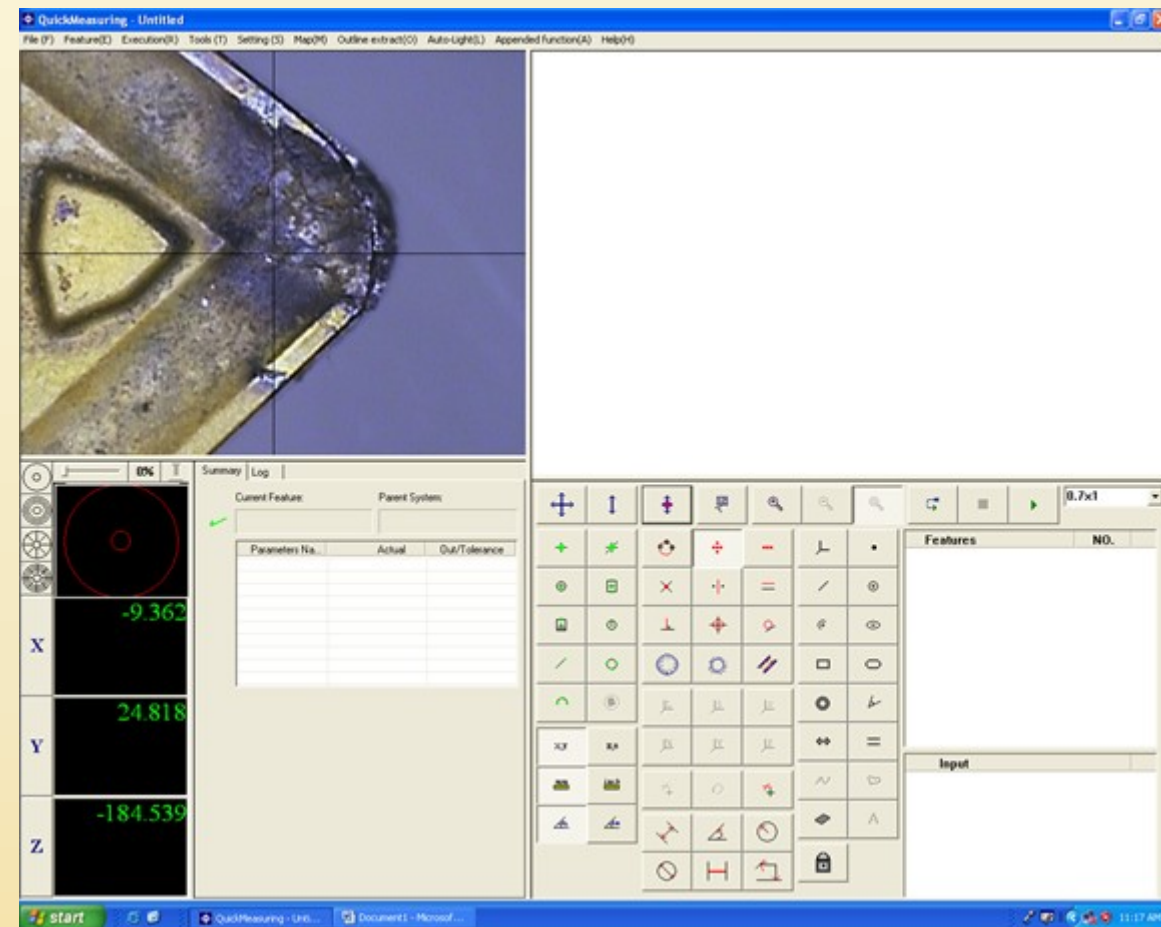
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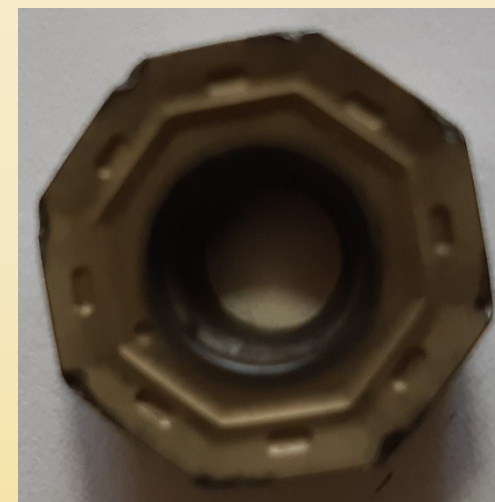
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Tipos de desgaste



-25-



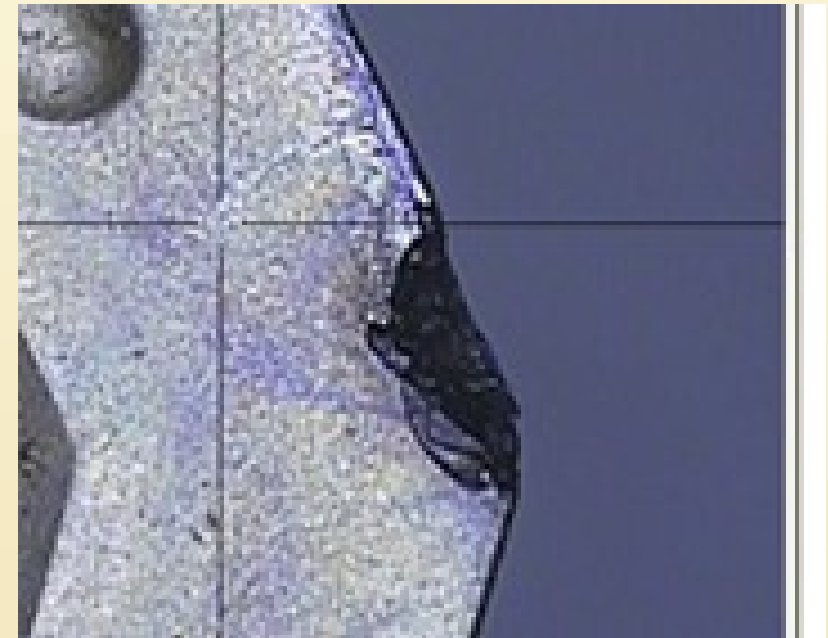
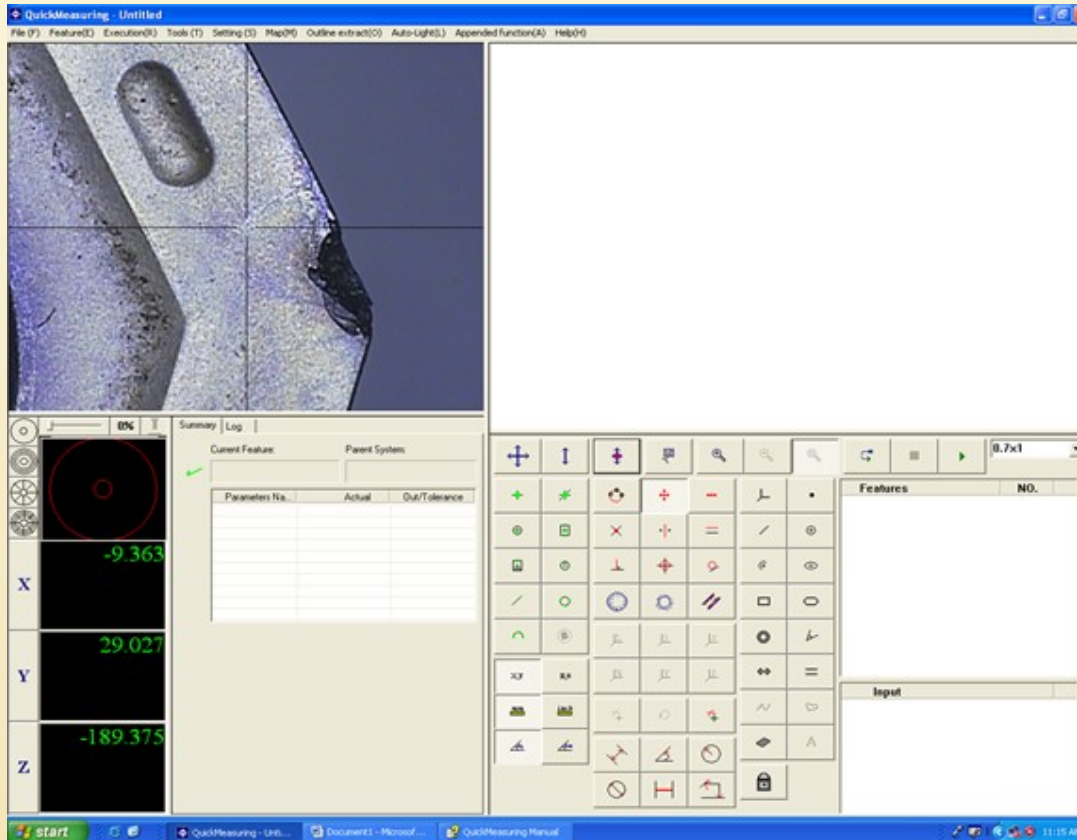
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Tipos de desgaste



-26-



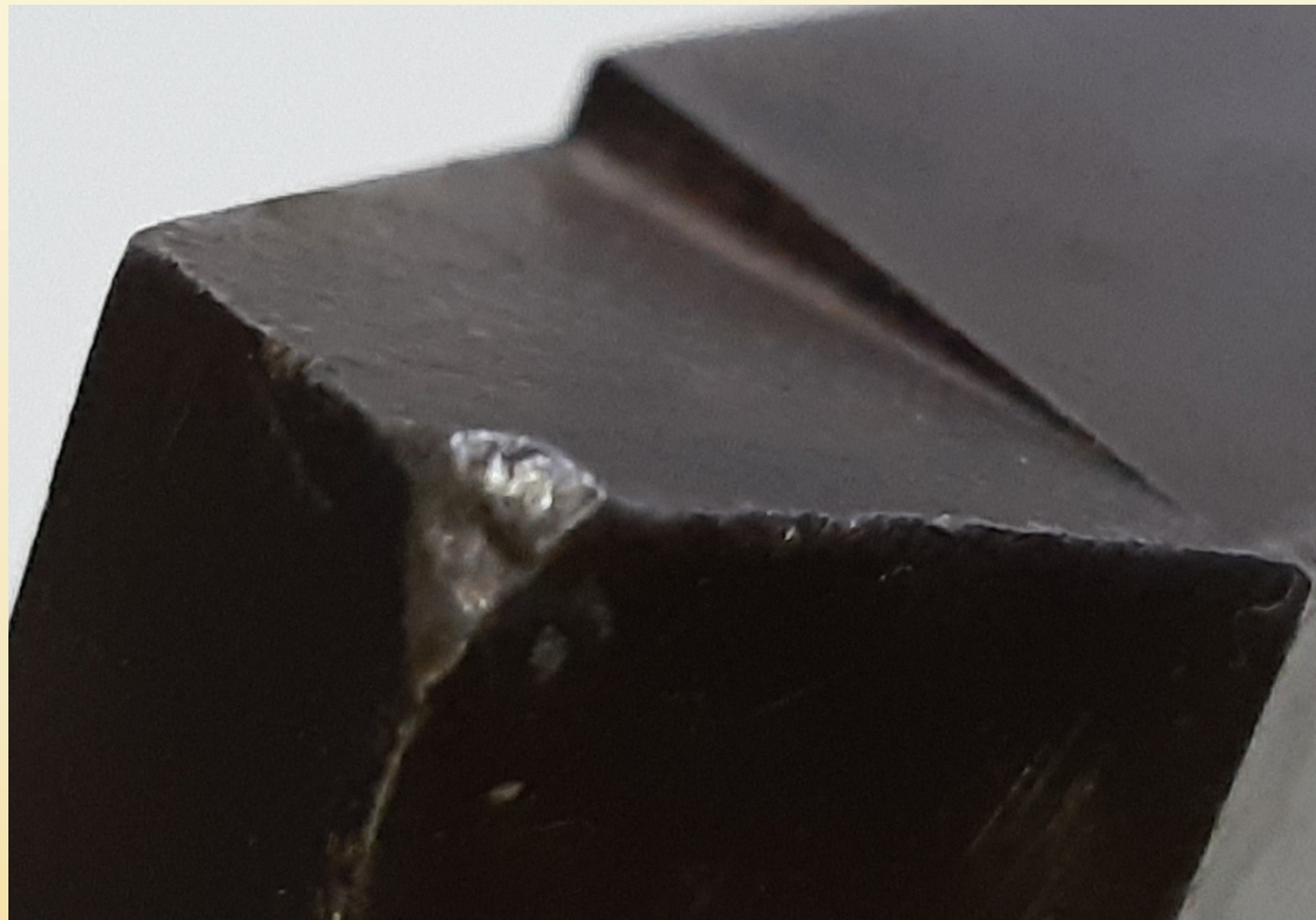
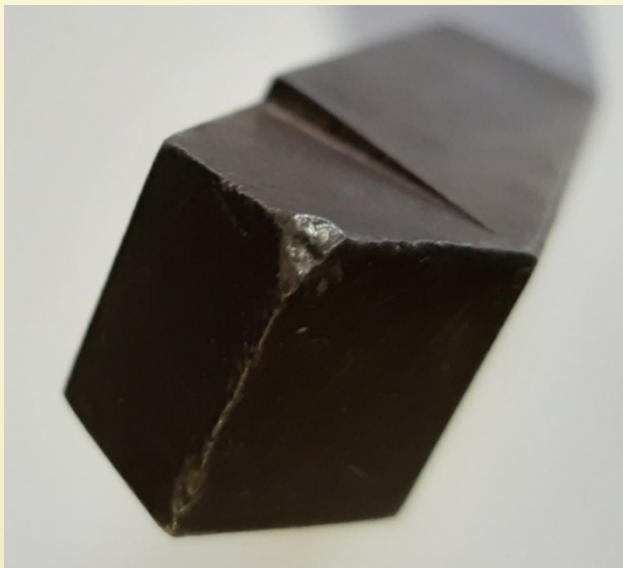
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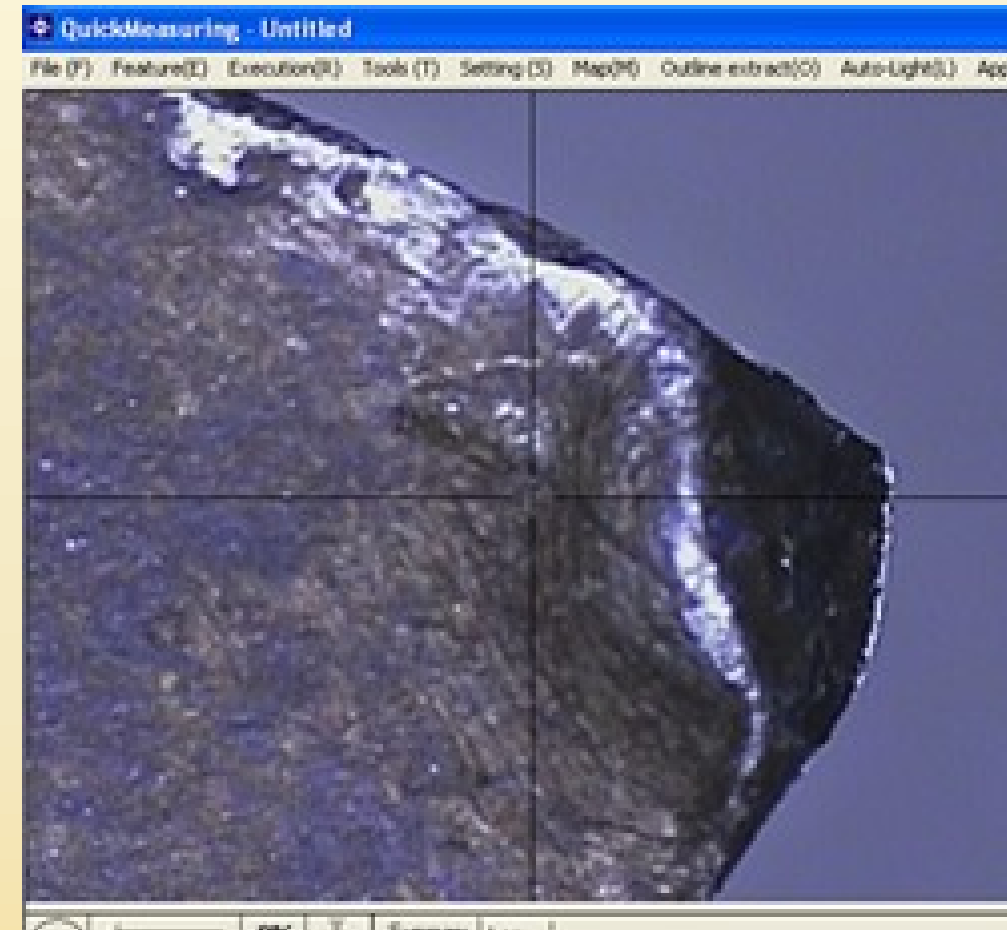
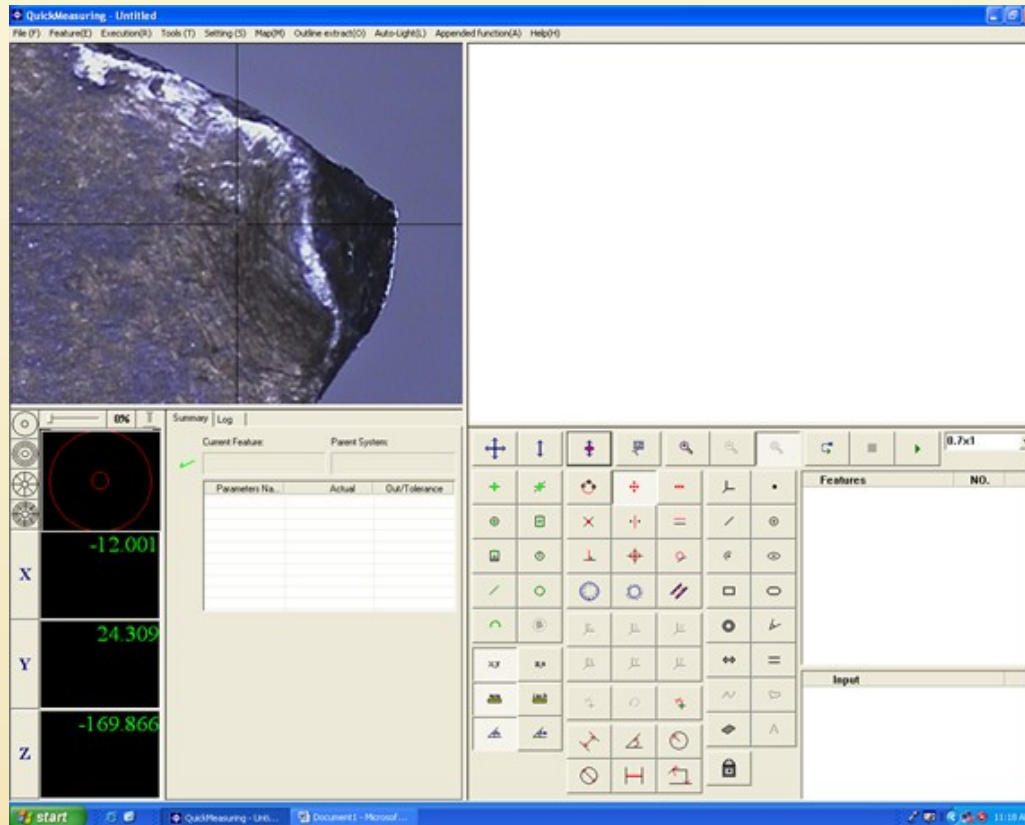


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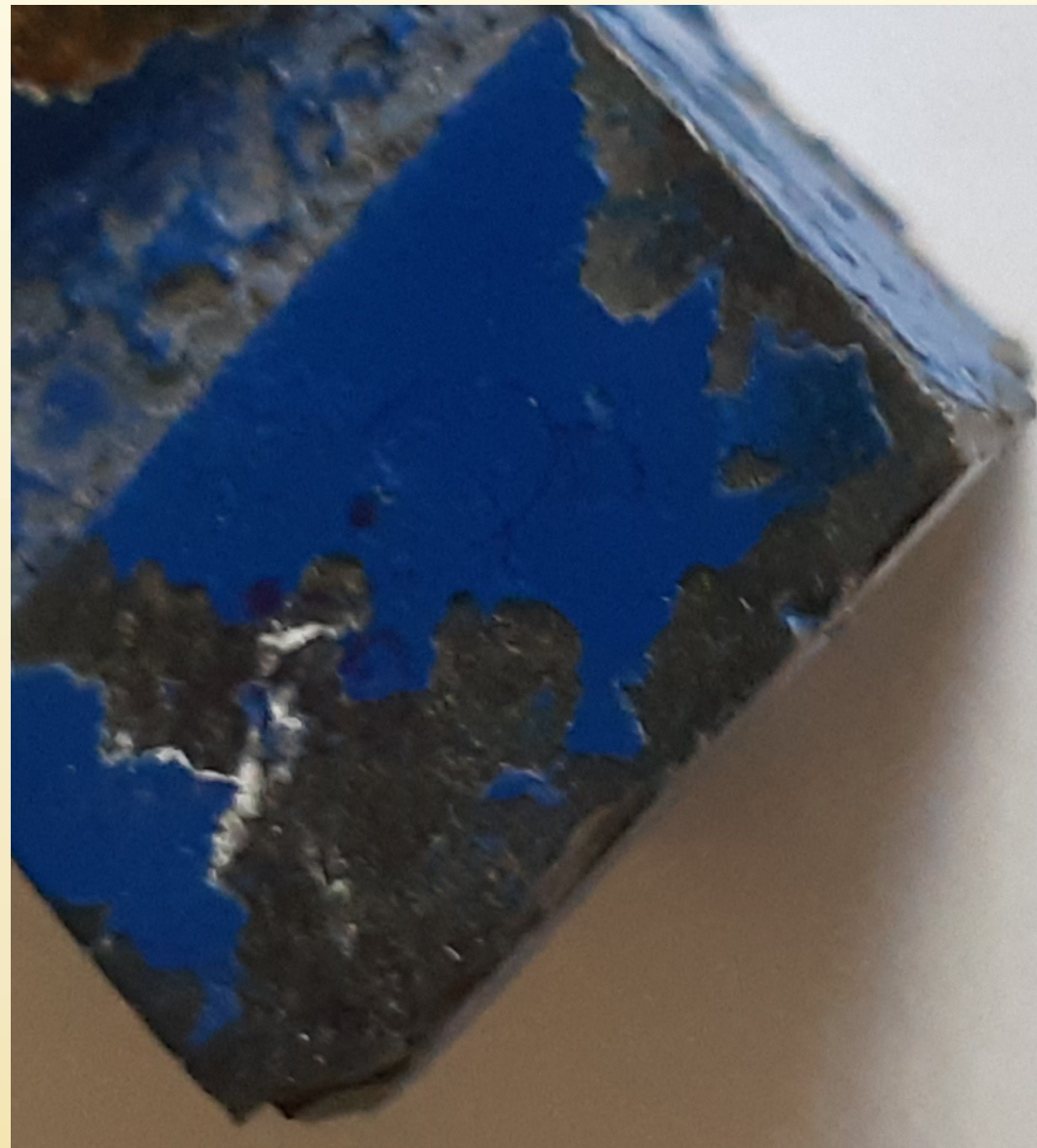


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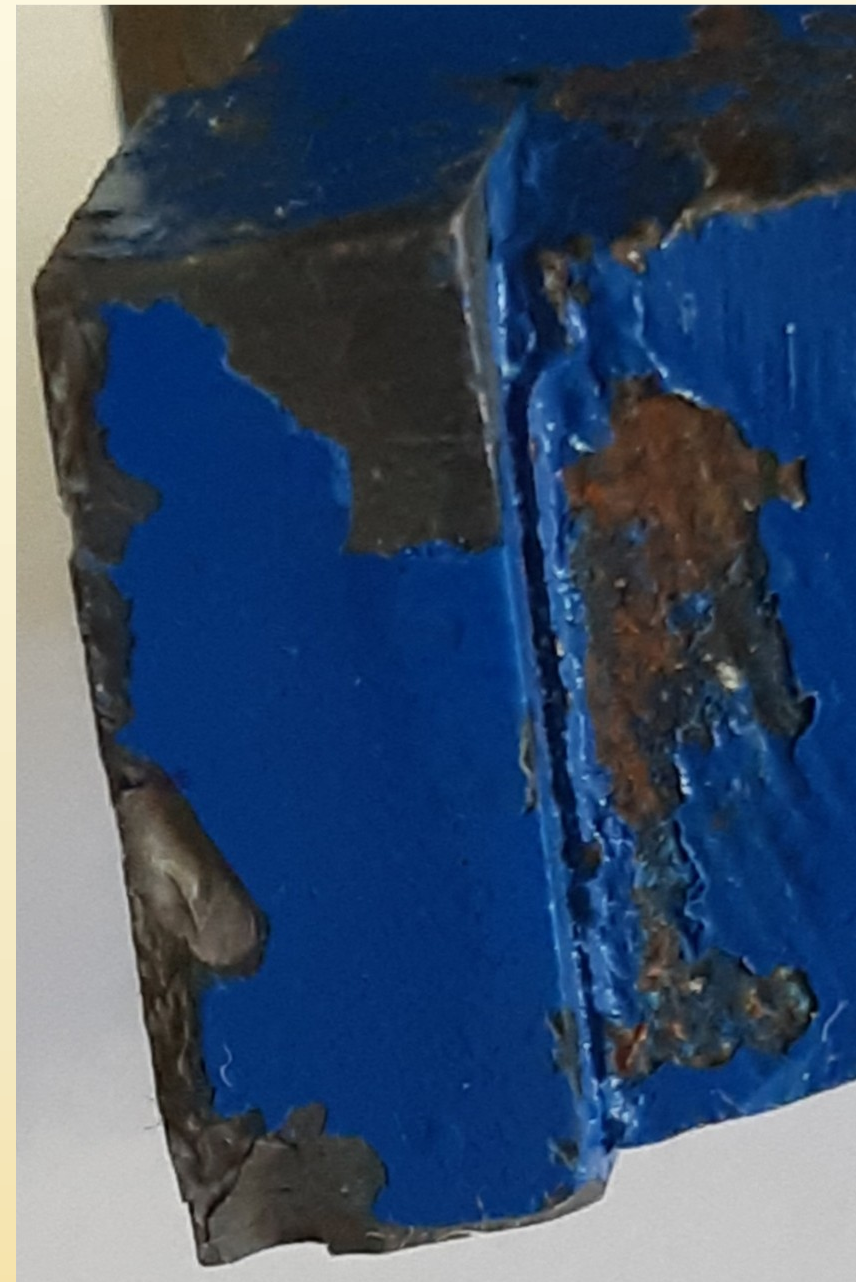
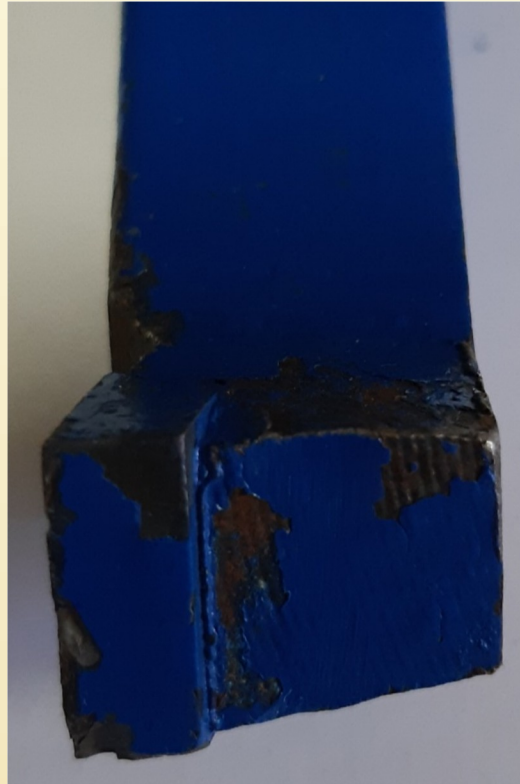


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