Factors: → ↓ cutting speed → coarse feed
→ ↓ rake angle → Insufficient cutting fluid
→ Large uncut thickness
→ Strong adhesion bet. chips & tool face.

Chip breakers:

→ Long and cont. chip formation @ ↑ cutting speed affects m/cing.
→ Spoils tool, work & m/c.
→ Chips - hard sharp & hot.
→ Dangerous & difficult to remove
→ Chip breakers help easy removal, provides safety and preventing damage
→ Used in automated machines running @ ↑ speeds.

(1) Step type (2) Groove type (3) Clamp type

5) Cutting Tool Materials:

→ Tool - harder than material to be cut

Parameters - Tool matr. selection:

1. Volume of production
2. Tool design
3. Types of m/c ing. process
4. Physical & chem. properties of work material
5. Rigidity & cond. of m/c.

Properties:

1. Hot hardness 2. Wear resistance

Types: - 1. Carbon tool steel 2. High speed steel
3. Cemented Carbides 4. Ceramics
5. Diamonds.

1. Carbon Tool steel:

C - 0.8 to 1.3 % | Si - 0.1 to 0.4% | Mn - 0.1 to 0.4%

→ ↓ cutting speeds, temp: < 200°C.
→ ✓ Hardness, strength & toughness
→ Good temp. tolerance.
→ Blades, hack saw blades, taps, etc.

→ Med. Alloy tools : W, Mb, Cr, & Vd.
→ 5% C + Cr + Mb - ↑ Hardness

2. High speed Steels:

→ Effective even on ↑ speeds.
→ Superior hot hardness, ↑ wear resistance
→ Maintain hardness upto 900°c.
→ ↑ Cutting speeds than Carbon steels.

Eg.: Tungsten, Cr, Vd, Co & Mb

Types of HSS:

i) 18-4-1 High speed Steel:

* 18% - W, 4% - Cr, 1% - Vd & 0.75% - C
* Great performance
* Hardness maintained upto 600°c

(ii) Mb HSS:

* 6% - Mb, 5% - W, 4% - Cr, 2% -
* Tough

(iii) Cobalt HSS:

* 12% - Co, W - 20%, Cr - 4%, Vd - 2
* Heavy duty & rough cutting tool
* Used in Milling cutter, Lathe tools etc.

3. Cemented Carbide:

→ Mix. of Tungsten powder & Carbon @ 1500°c, 4:6 ratio.
→ 82% WC, 10% - TiC & 8% - Co & it is usually taken from inserts (either brazed or clamp)
→ These clamps are thrown after wearing out all cutting edges and this tool withstands temp. upto 1000°c.
→ 6 times speed than HSS.
→ Brittle & low resistance to shock.

4. Ceramics:

→ Mix of AlO_2 & BN & sintered @ 1700°c which has very hard & good compressive strength.

→ Brittle, can't be used in shock & vibrations

→ 90% AlO_2 + 10% CrO_2, MnO_2 & NO_2

→ High compressive strength, longer tool life, flexibility, good surface finish & high temp. resistance 1000°c

Prop.: * ↑ cutting speeds
* Rigidity of tool & w/p
* ↑ surface finish on cutting tool
* Eliminates unbalanced forces.

5. Diamonds:

→ Hardest cutting materials.

→ Polycryst. made by sintering under high pressure & temp.

→ Has low coeff. of friction, comp. strength ↑ & wear resistance.

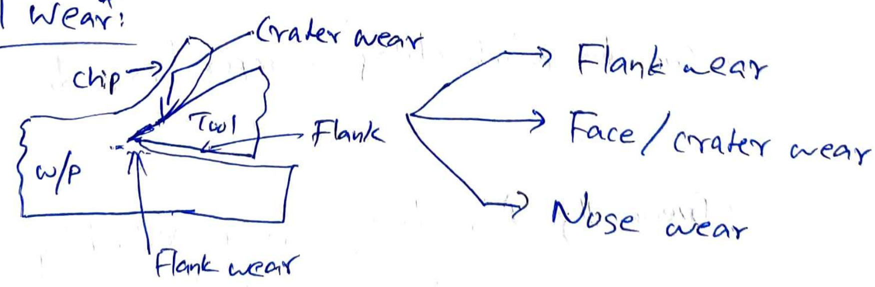
→ Used for machining very hard materials like glass, plastics, ceramics, etc.

→ ↑ surface finish @ ↑ speeds & good dimensional accuracy.

→ Very expensive & brittle

Prop.: * Hardest sub.
* ↓ coeff. of friction
* ↑ Heat cond.
* ↓ elec. cond.

Tool Wear:



Flank wear: → edge wear aka Flank wear
→ Friction, abrasion & adhesions – main cause
→ Flat worn out region behind cutting edge.
→ Takes place in rough machined surface