Turning With Carbide

Founded in 1945 by
Walter Greenleaf, Sr.

Family owned and operated

Facilities in PA and NC

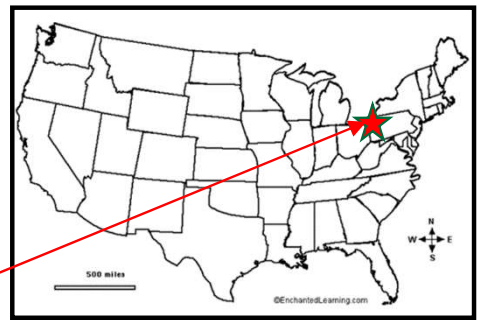
Sales in over 70 countries

Facilities in Saegertown, PA

Greenleaf Europe and Greenleaf China

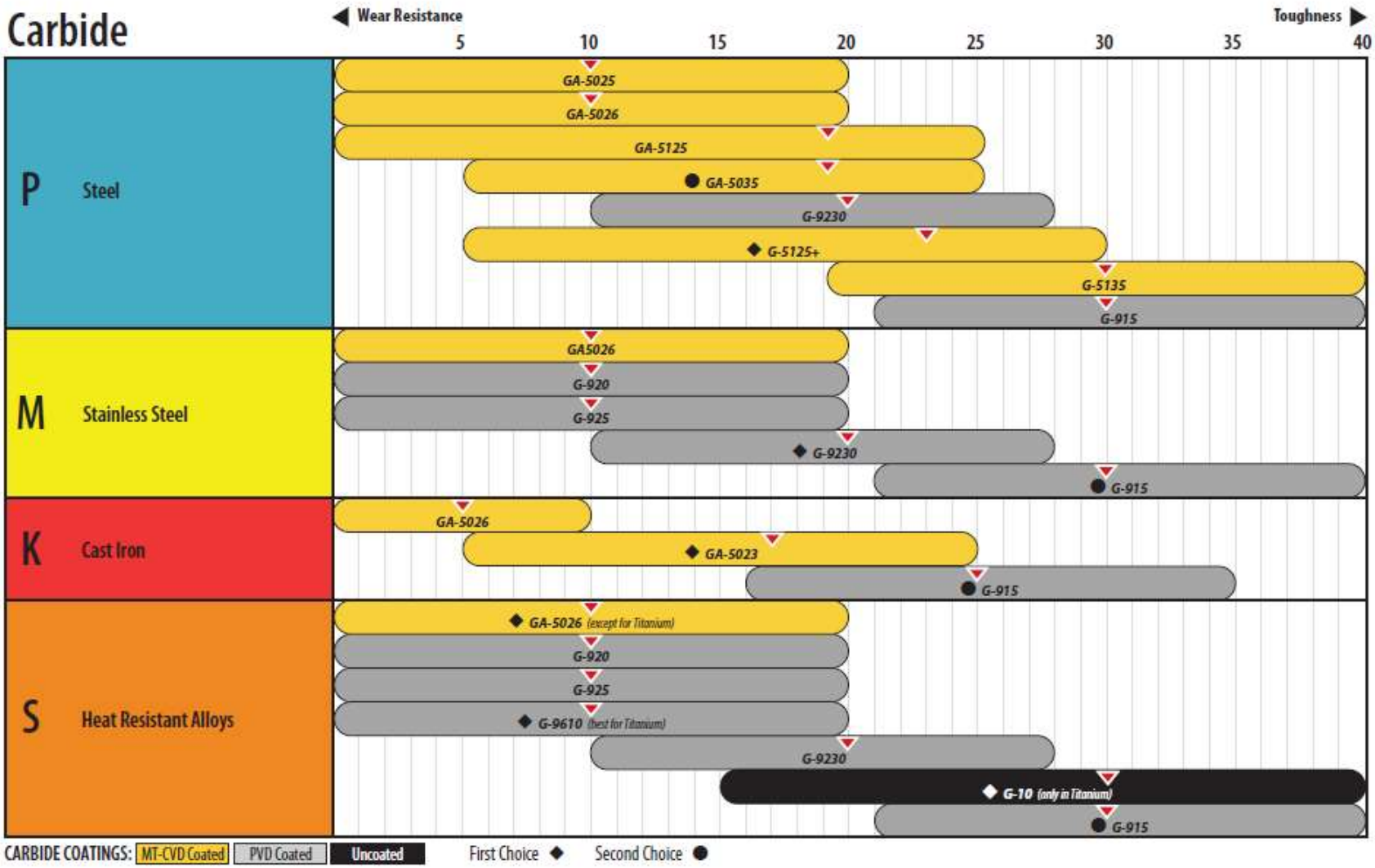
Greenleaf Corporation designs and manufactures standard and special ceramic and carbide inserts and the supporting steel tooling.

**Greenleaf Corp,
Saegertown, PA**



Grade Choices- Carbide

Turning

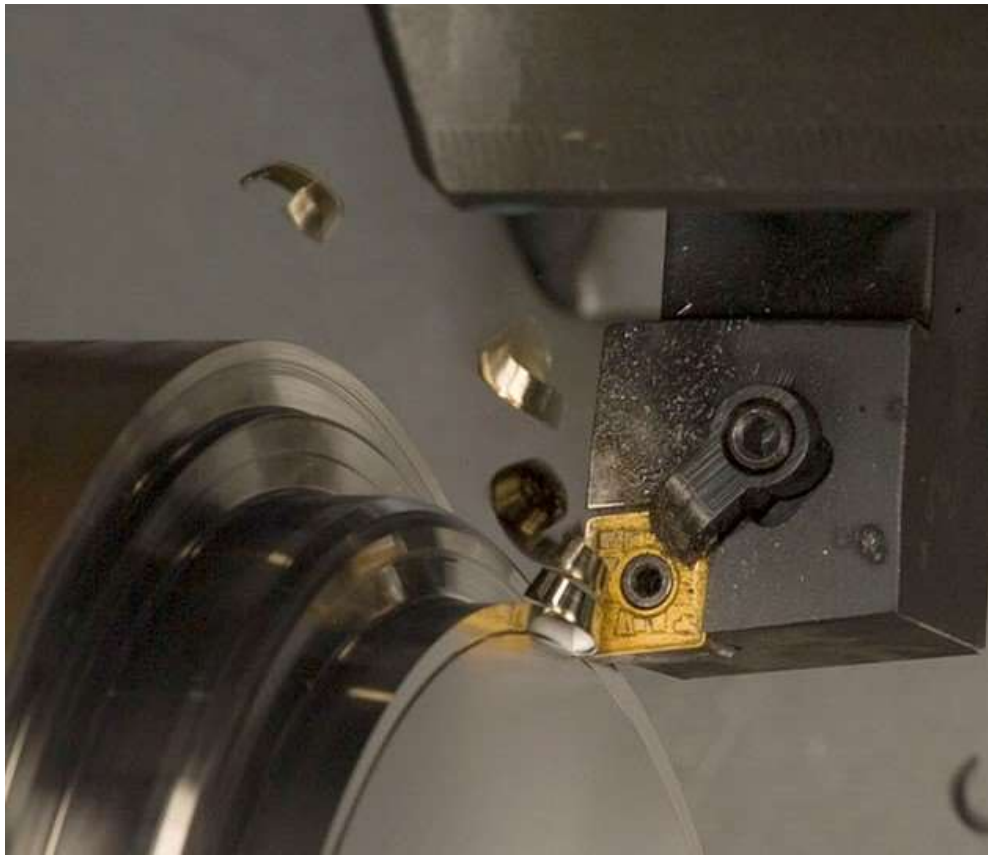


Factors Affecting Grade Choice

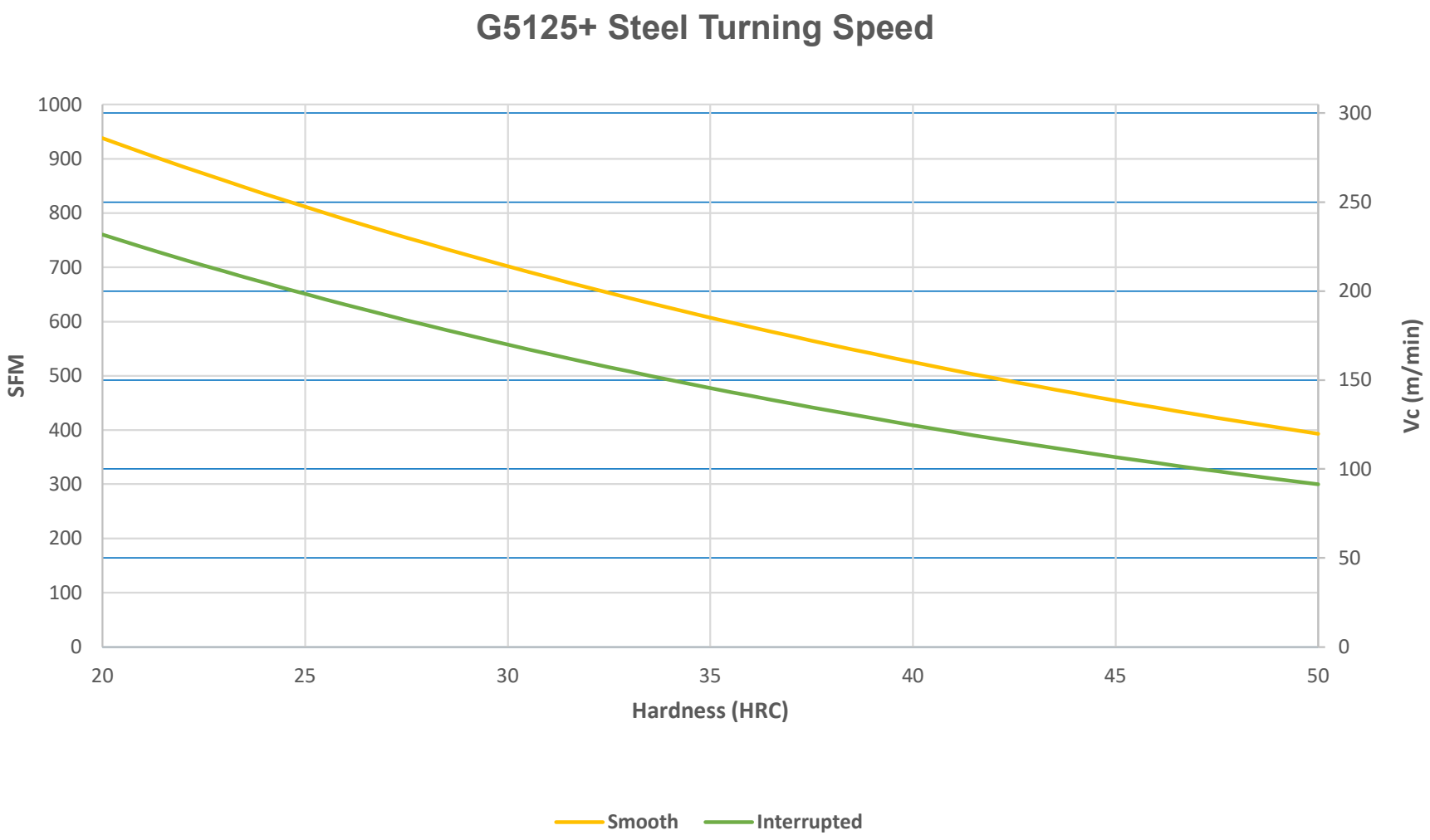
- Work Material
- Operation
  - Roughing
  - Finishing
- Machine / Workholding / Setup
- Objective
  - Improve Tool Life
  - Increase Productivity
  - Improve Surface Finish

Factors Affecting Grade Choice
Work Material- Steel

- Carbon steels
  - 1010, 1020, 1030, etc.
- Alloy steels
  - 4140, 5132, 8620, etc.
- Tool steels
  - D2, M4, S7, P-20, etc.



Factors Affecting Grade Choice
Work Material- Hardness & Interruptions



Factors Affecting Grade Choice

Objective- Toughness vs Wear Resistance

Cemented tungsten carbide (WC + Co)

Cobalt content ranges from…

10% to 4%

Toughness → → → Wear Resistance

Large / Dissimilar Grain Size Fine / Similar

TiC and/or TaC added for resistance to crater wear and thermal shock

Factors Affecting Grade Choice
Coatings

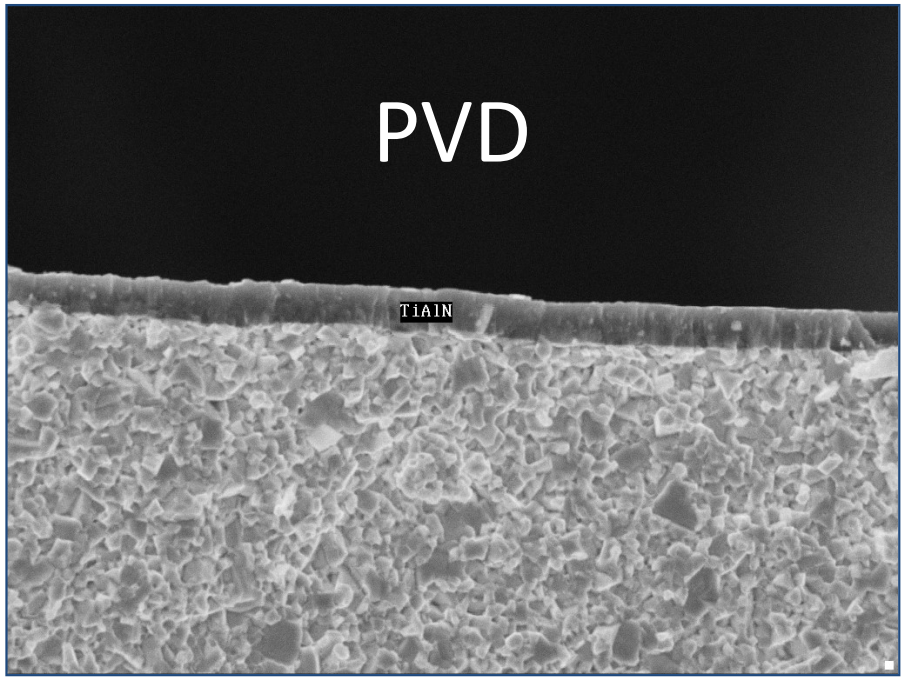
- ✓ *Thermal barrier at the cutting edge*
- ✓ *Provide lubricity for chip flow*
- ✓ *Reduce chip weld*

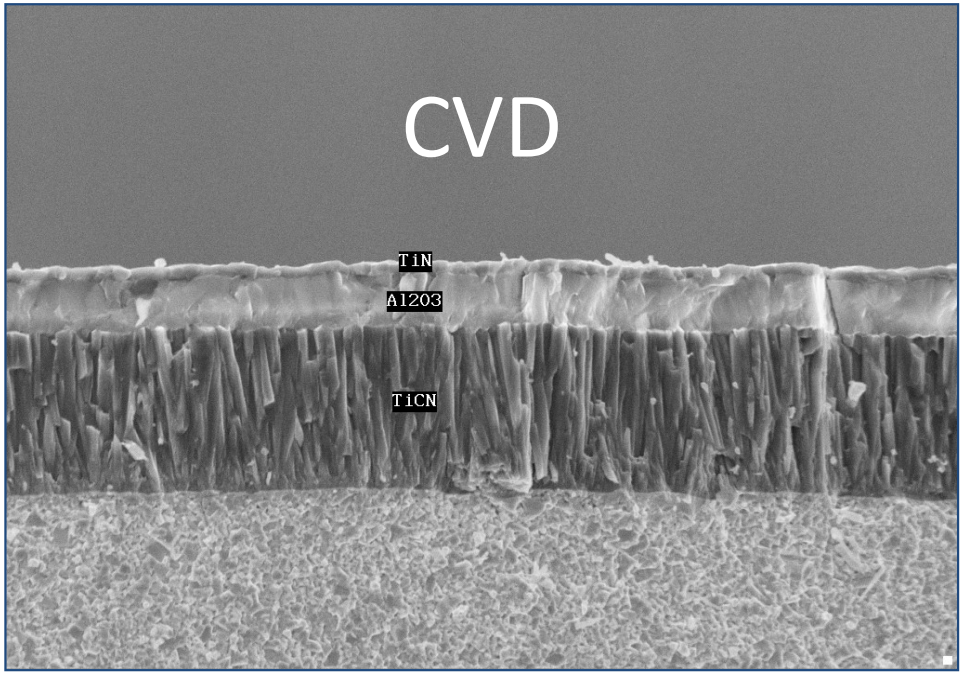
Selecting the best coating for an application is based on understanding of the processes and key properties.

PVD vs. CVD

Factors Affecting Grade Choice

Coatings

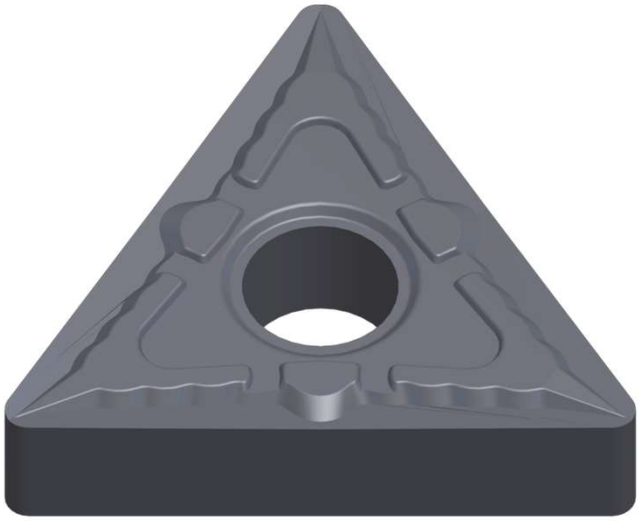




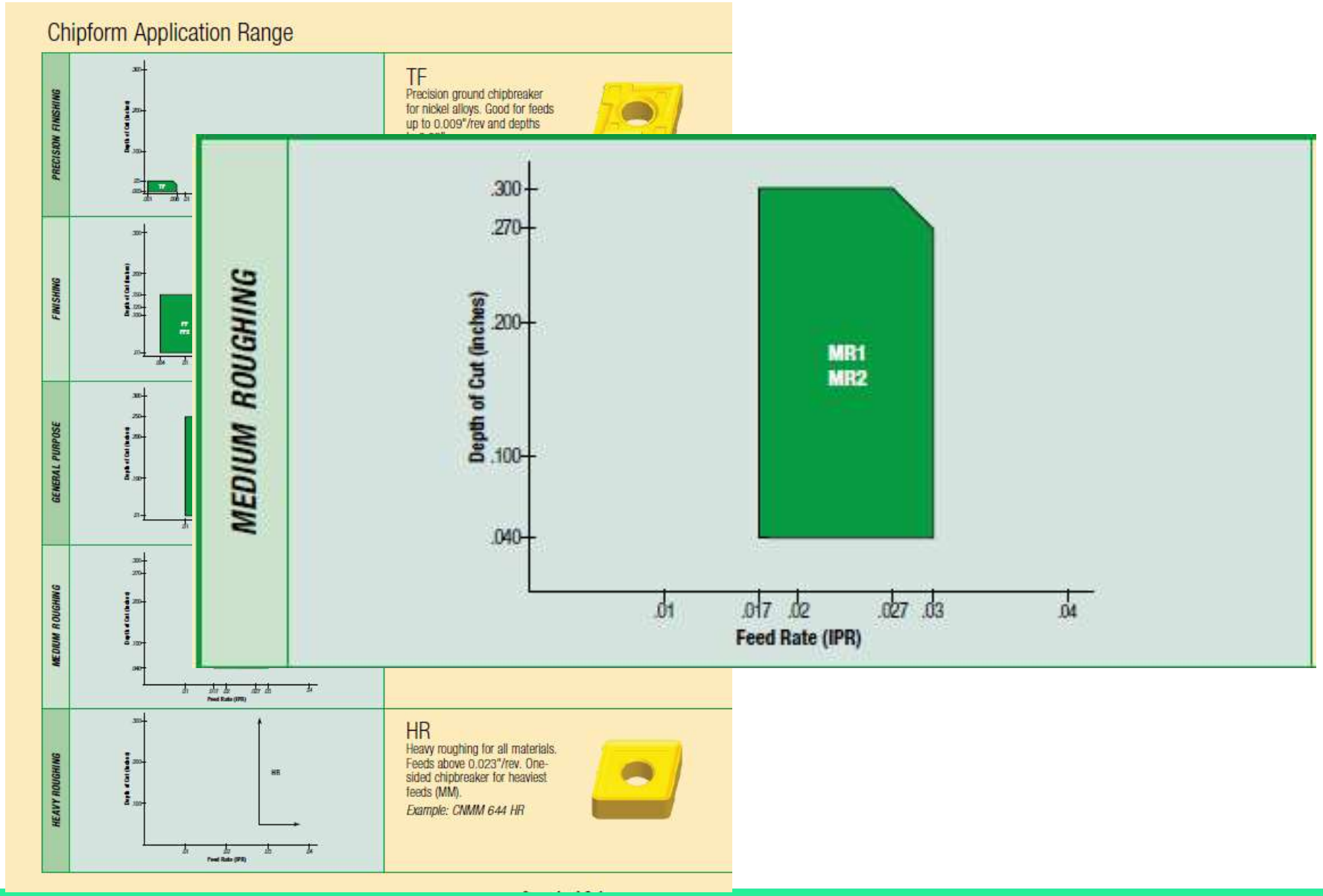
- Thinner
- Sharper
- Stronger

- Thicker
- More wear resistant
- Better thermal barrier

Chipforms



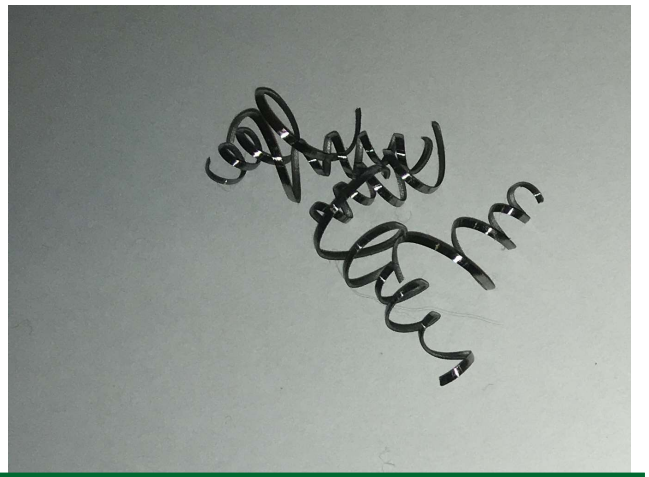
Chipform- Application Ranges



Chipform- Affect of DOC

All passes were ran at same speed and feed rate

0.020” DOC



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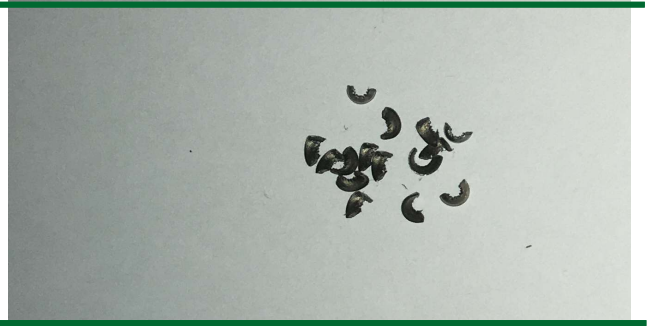

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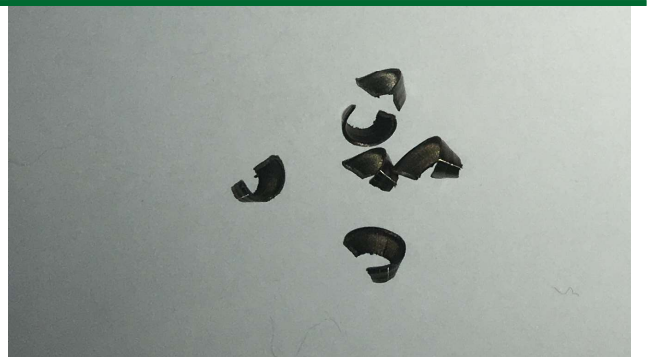
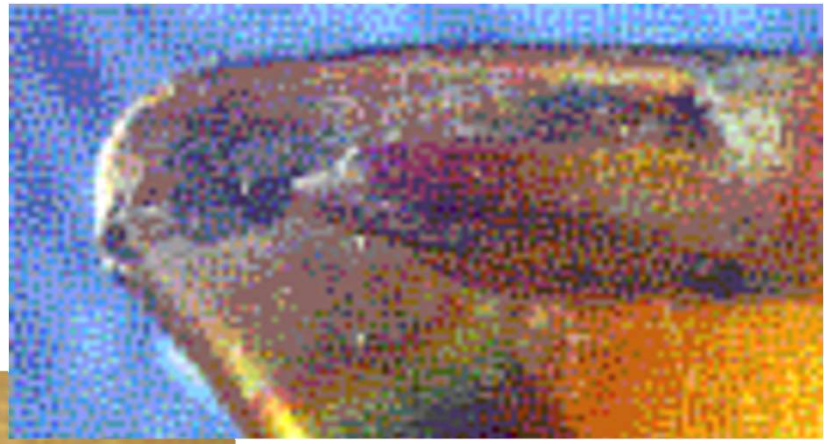
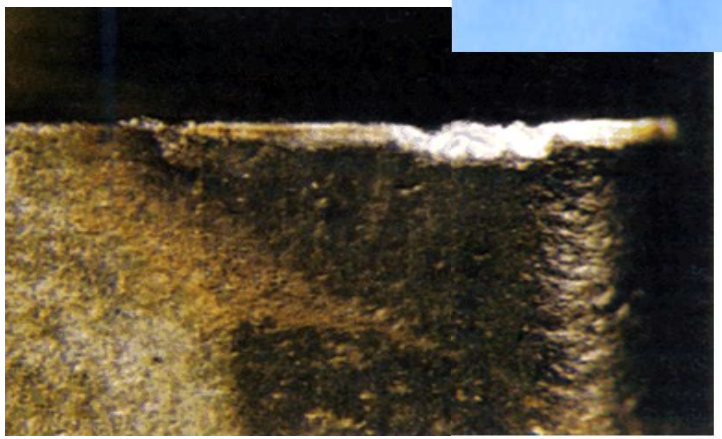


Types of Wear



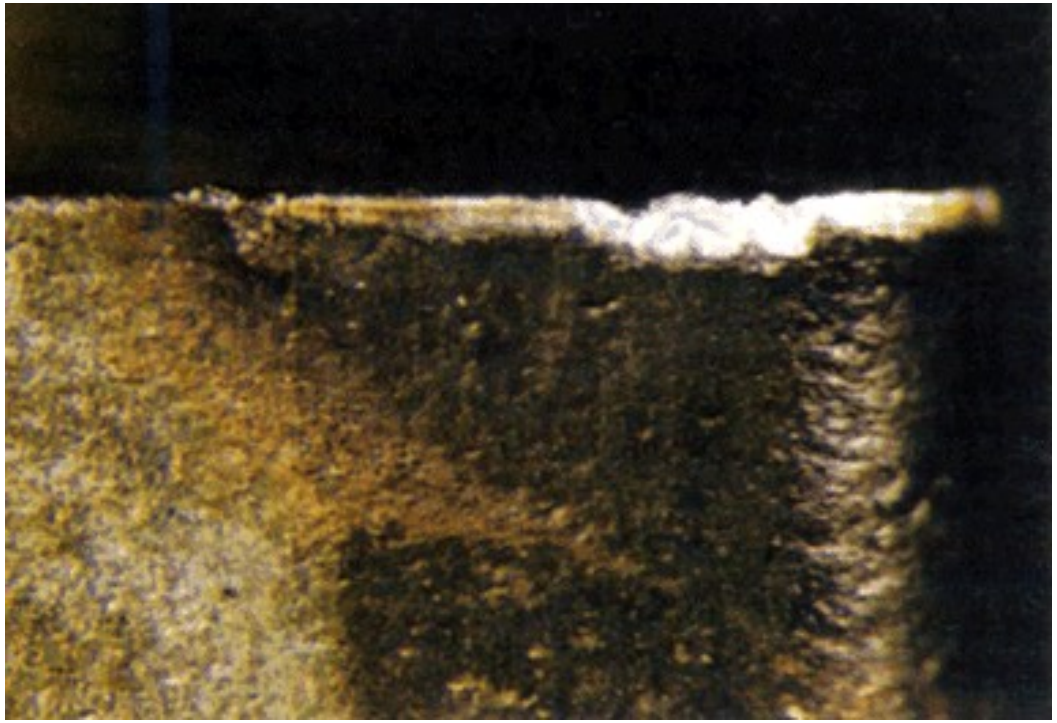


Types of Wear

Flank Wear

- **CAUSE:** Normal abrasion & thermal breakdown
- **SYMPTOMS:** Even wear pattern throughout the cutting zone, consistently happening.
- **TREATMENT:** Adjust cutting speed up or down to alter time in the cut
- **PREVENTION:** None – This is what you want to see. Choose the correct grade of carbide – cutting speed – and feed rate

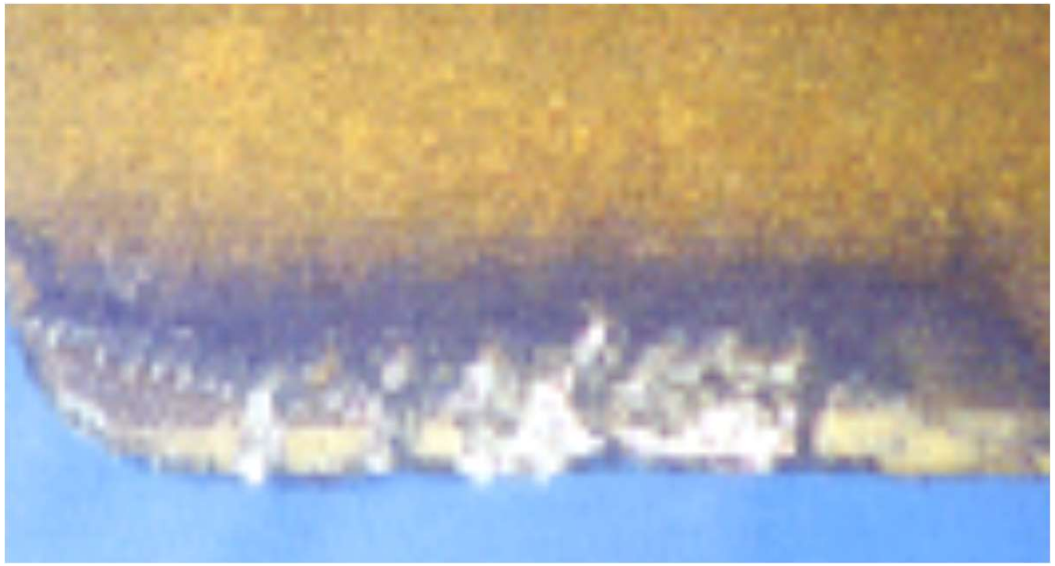
Types of Wear



Chipping

- **CAUSE:** Cutting speed too slow, not enough heat generated to soften the material or too hard of a grade of carbide
- **SYMPTOMS:** Premature wear, random tool failures. Chips can be detected by sight or touch. “Sparking” and poor surface finish.
- **TREATMENT:** Increase cutting speed to add more heat. Choose a tougher grade of carbide. Reduce feed rate slightly if double cutting chips. Use inserts with a stronger cutting edge geometry.
- **PREVENTION:** Check inserts early and often to identify the problem. Match the carbide grade to the material. Check the hardness of the material before starting

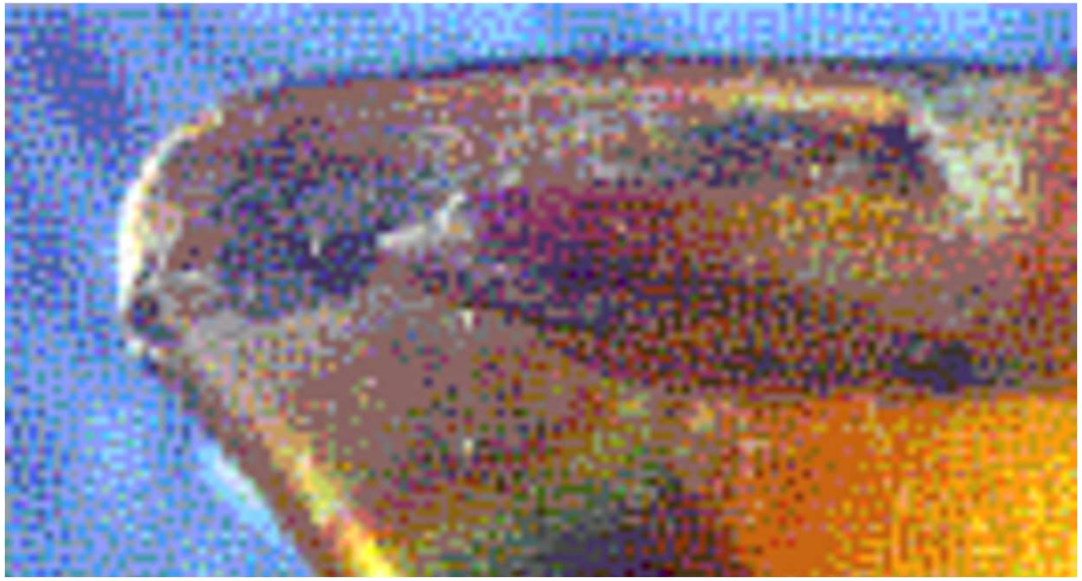
Types of Wear



Thermal Cracking

- **CAUSE:** Rapid changes in temperature – heat is rapidly increased during the cut cycle
- **SYMPTOMS:** Fine hair-like cracks perpendicular to the cutting edge – random failures after wear pattern seems to be established
- **TREATMENT:** Inspect inserts closely. Assure adequate coolant reaches cutting edge. Turn coolant off on interrupted cuts.
- **PREVENTION:** Check coolant concentration and type. Choose a “softer” tougher grade of carbide.

Types of Wear



Plastic Deformation

- **CAUSE:** Too much heat in the cutting zone. Carbide tool begins to meet its softening point. Chemical reactions change the matrix.
- **SYMPTOMS:** Cutting edge distorts. Rapid changes in power usage and surface finish. Changes in dimension
- **TREATMENT:** Reduce cutting speed. Increase coolant flow to insert tip. Choose a “Harder” more wear resistant carbide grade
- **PREVENTION:** Choose a very wear resistant grade. Carefully select cutting speeds and feeds. Don’t try to increase productivity through increased cutting speed.

Types of Wear

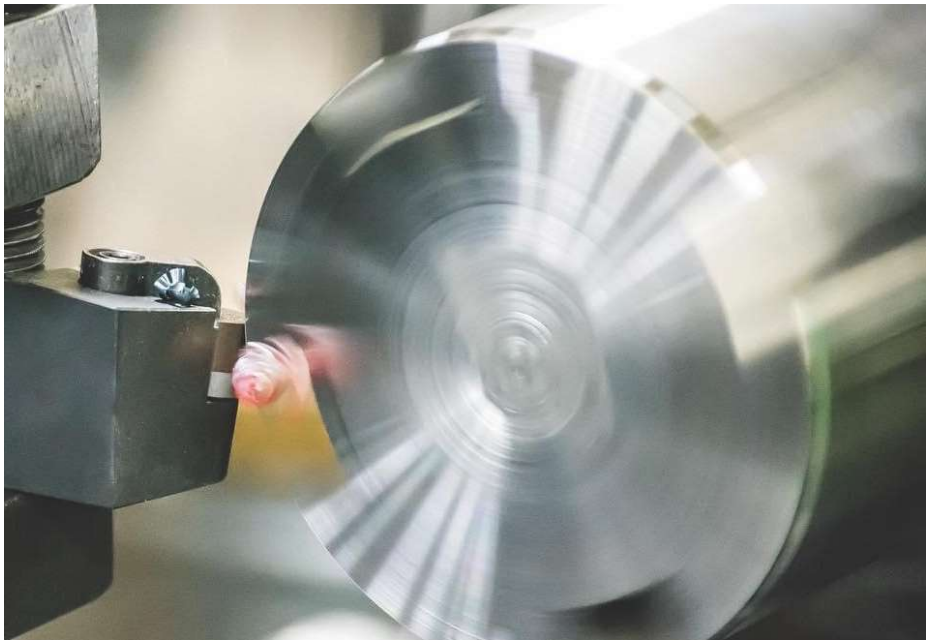
Build Up Edge

- **CAUSE:** Too low of a cutting speed or other conditions that allow metal to “stick” to the tool – Cutting below centerline when Turning – Negative rake tools
- **SYMPTOMS:** Metal can be felt or observed on the cutting edge. Very erratic tool life. Poor surface finishes in Turning. Tool failures are often sudden and fatal.
- **TREATMENT:** Adjust cutting speed. Choose a more positive geometry insert or harder, more wear resistant grade of carbide. Coating with more lubricity.
- **PREVENTION:** Choose correct cutting speeds and insert geometry. Better to cut at too high of a cutting speed than one too slow. Always use a coated grade of carbide for materials that are “gummy” and cause BUE

Cutting Through Interruptions

Tips for best practices to cut through interruptions

- Use tougher carbide grade.
- Use chipform with larger land- avoid high positive chipform.
- Maintaining speed- avoid reducing speed just because of interruptions.



Summary

- Material, hardness, and condition are key for selecting the best insert
- Review setup and operation to see if adjustments need to be considered
- Understanding insert wear can help guide improvements for grade, coating, chipform