**Tool Material:**

- High Speed Steel (HSS)
  - Use with softer materials (aluminum, plastic)
  - Cheaper and more common
  - Weighs less and appears brighter
  - Can be coated, in which case it will appear golden over the cutting area
  - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)

- Carbidé
  - Use with harder metals (carbon steel, titanium)
  - More expensive and brittle
  - Heavier and appears darker (gun metal)
  - Can be carbide tipped, in which case it will be a small carbide cutting surface brazed onto an HSS carrier

- Cobalt
  - For use with stainless steel only
  - Similar weight and appearance to carbide, with less shine and blue tint
  - Very uncommon in Idaho Machine Shop
  - Ask Russ if you think you need it

**Endmills:**

- **Center Cutting vs Non-Center Cutting**
  - Center Cutting
    - There is no hollowed out center
    - Allows the user to plunge, drill or ramp into a cut
    - Greatest variety of applications
    - More expensive to manufacture
  - Non-Center Cutting
    - Hollowed out center
    - Cannot plunge into materials
    - Cheaper to produce

- **Number of Flutes**
  - 2-Flute
    - Cutting surfaces spaced wider
    - Better for plastics and soft metals, like aluminum
    - Slightly higher feed rate
    - More stress on each cutting surface
    - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)
  - 4-Flute
    - Cutting surfaces closer together
    - Better for harder metals, like steels
    - Slightly lower feed rate
    - Distributes stress across more cutting surfaces
    - Refer to “Feeds and Speeds” chart for RPM and feed rate

- **Side profile of endmill has pointed tip**
  - Used for cutting chamfered edges or specific angled surface facing
  - Specified by endmill diameter and cutting angle
  - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)

- **Radius Mill**
  - Side profile of endmill inner-radius tip
  - Used for cutting filleted outside edges
  - Specified by endmill diameter and cut radius
  - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)

- **Chamfer Mill**
  - Side profile of endmill has rounded tip
  - Used for cutting chamfered edges or specific angled surface facing
  - Specified by endmill diameter and cutting angle
  - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)

- **Ball End Mill**
  - Side profile of endmill has rounded tip with diameter equal to endmill diameter
  - Used for cutting filleted inside edges, spherical holes, or rounded 3-D surface facing
  - Refer to “Feeds and Speeds” chart for RPM and feed rate (based on endmill diameter)

- **Square End Mill**
  - Side profile of endmill has square tip
  - Used for cutting square edges, such as channels, pockets, and facing operations
  - Most common endmill type
  - Refer to “Feeds and Speeds” chart for RPM and feed rate

**Facing Tools:**

- **Fly Cutter**
  - For removing large amounts of material in a radial plane or surfacing large areas
  - Using set screws, set diameter of cut
  - Operate at 50% of RPM and feed rate indicated by “Feeds and Speeds” chart
  - Ask a mentor or Russ if you think you need it

- **Facing Mill**
  - For facing a large surface to near-mirror finish or planing large areas quickly
  - Select facing tool (HSS vs. Carbide)
  - Refer to “Feeds and Speeds” chart by outer diameter of facing tool
  - Some can be operated at higher feed rate. Ask a mentor or Russ

**Slot Cutters:**

- **T-Slot Cutter**
  - Cut side slots, full t-slots, and keyways straighter than an endmill
  - Before employing T-slot cutter, remove as much material as possible with an endmill
  - Determine thickness and width of slot or keyway to be cut
  - Select cutter with appropriate dimensions
  - Operate slot cutter at 70% of speed indicated by “Feeds and Speeds” chart

- **Dovetail Mill**
  - For cutting dovetail side cut or full dovetail cuts
  - Specified by major diameter and cut angle
  - Operate at 70% of RPM and feed rate indicated by “Feeds and Speeds” chart

- **Thin Slot Cutter**
  - For cutting thin side slots or keyways
  - Determine thickness and depth of slot to be cut
  - Select cutter with appropriate dimensions
  - Mount cutter to appropriate stub arbor (see below)
  - Operate slot cutter at 70% of speed indicated by “Feeds and Speeds” chart

**Stub Arbor:**

- **Stub Arbor**
  - For mounting thin slot cutters and large diameter dovetail cutters
  - Specified by arbor diameter
  - Remove locknut and washer from end, slide cutter onto arbor, aligning slot on tool with key on arbor, and replace washer and locknut
  - Tighten until tool is immovable, but without causing deflection