Carbide parts production

Carbide parts are fabricated by a number of methods.Due to their size,level of shape complexity and manufactured quantities, most cutting inserts are pressed in a rigid die with top and bottom punches. The same amount of powder in terms of both mass and volume must flow into the die cavity for each pressing to maintain uniform part weight and size. Powder flowability is mostly controlled by the agglomerate size distribution and the organic binder's properties. Compaction pressures of 10 to 80 ksi are applied to the powder to form the pressed,or "green",part.
Even at these pressures, the hard WC particles do not deform or fracture,but the organic binder is forced into the interstices between the particles,helping to lock them into place. Higher compaction pressures bring the WC particles closer together,increasing the part's pressed, or green density. The pressing characteristics of graded WC powders can vary depending on the metal binder content,particle size and shape, degree of agglomeration, and composition and amount of organic binder. Plots of green density vs.compaction pressure are often constructed by the powder producer to provide quantitative information on the pressing characteristics of graded WC powders. This information ensures that the powder will be compatible with the toolmaker's compaction process.

Large carbide parts or those with high aspect rations,such as rods for endmills and drills, are often manufactured by isostatically pressing graded WC powder in a flexible bag. Production cycles are longer than for die compaction, but the tooling cost is lower,making isopressing more suited for lower volume production.

In this process, the powder is poured into the bag, the end of the bag is sealed off, and the powder-filled bag is placed in a chamber,which is pressurized to 30 to 60 ksi with a hydraulic fluid. The pressed part is often machined to a specific geometry before being sintered. The bag is oversized to accommodate part shrinkage during consolidation and to provide adequate stock for grinding.

Because the parts are machined afterward,uniform powder packing is not as critcial as for die compaction, but it is still desired to ensure that the bag is fulled with the same amount of powder each time.If the powder has a low packing density,the bag may be filled with insufficient powder,resulting in undersized parts that have to be scrapped. If the powder has a high packing density, the bag may be filled with excess powder, requiring more powder to be machined away after pressing. Although this powder is recycled along with that from any scrapped parts, it reduces process efficiency.
Carbide parts can also be produced by extrusion or injection molding. Extrusion is better suited to high-volume axisymmertric parts,while injection molding is used for producing complex geometries in high volumes.in both processes, the graded powder is suspended in an organic binder, which gives the mixture the consistency of toothpaste. The mixture is then either extruded through an orifice or injected into a die cavity. The characteristics of the graded powder determine the optimal ratio of powder to binder in the mixture and greatly affect the mixture's flow properties through the orifice or into the die cavity.