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ASK OUR EXPERT— Cemented Carbide

How to define the cemented carbide ?

Cemented carbide is a hard material used in machining tough materials such as carbon steel or stainless, as well as in situations where other tools would wear away, such as high-quantity production runs. Most of the time, carbide will leave a better finish on the part, and allow faster machining. Carbide tools can also withstand higher temperatures than standard high speed steel tools.

Is there any difference between cemented and tungsten carbide?

Cemented carbides consist of hard grains of the carbides of transition metals (Ti, V, Cr, Zr, Mo, Nb, Hf, Ta, and/or W) cemented or bound together by a softer metallic binder consisting of Co, Ni, and/or Fe (or alloys of these metals). Tungsten carbide (WC), on the other hand, is a compound of W and C. Since most of the commercially important cemented carbides are based on WC as the hard phase, the terms "cemented carbide" and "tungsten carbide" are often used interchangeably.

Is there any key points I should concern about when selecting a grade for my application?

The key properties of cemented carbides that define their performance level for different applications include abrasion resistance (directly related to the hardness of the grade), fracture strength, and fracture toughness. In general, the abrasion resistance or hardness of any grade is inversely proportional to its fracture toughness. Very often grade selection involves finding the best compromise between abrasion resistance and toughness. In some instances strength and corrosion resistance can be important factors in the grade selection process.

Which grade characteristics affect the properties of cemented carbide?

The properties of cemented carbides are affected by four primary material characteristics, namely, (i) the average grain size of the carbide phase, (ii) the weight or volume percent of the binder alloy present, (iii) the composition of the carbide phases, and (iv) the composition of the binder alloy. In general, hardness increases (and fracture toughness decreases) as the average

Hard phase grain size decreases and/or the weight or volume fraction of the binder decreases.
The strength increases as the average grain size of hard phase decreases at any given binder fraction.
Corrosion resistance increases as Ni and/or Cr is substituted for Co in the binder alloy.

Which properties are important in metal cutting applications?

Depending upon the type of metalcutting operation (turning, milling, drilling, etc.), different combinations of properties is needed in order to obtain optimum results. For example, in turning and drilling applications the cutting tool is in continuous contact with the workpiece. Hence, for these applications, abrasion resistance and strength are the most important properties to consider.
However, in operations such as milling, which invariably involve interrupted cutting, and hence high impact forces, toughness can be an important factor. Grades employed for metalcutting applications are usually based on fine to medium hard phase grain sizes (0.5 to 1.5 mm) and low to medium Co contents (6 to 15 wt.%).

Are grades used for cutting nonferrous metals different from those used for ferrous metals?

Yes. Grades used for cutting nonferrous metals are usually based on WC as the hard phase and Co as the binder phase. On the other hand, grades used for cutting ferrous metals usually contain other hard carbides (e.g., TiC, TaC, NbC, etc.) besides WC. The presence of the TiC, TaC, NbC, etc. is useful in preventing chemical interactions between the ferrous metals and the cutting tool (which can lead to cratering on the surface of the tool). In addition, carbides such as TiC, TaC, NbC, etc. can help increase the hot hardness and strength of cemented carbides.

Which grades are useful in metal forming applications?

In contrast to metalcutting (where abrasion resistance and strength are of paramount importance), cemented carbides used in metalforming applications will invariably be subject to high impact and shock forces. Hence, grades used for metalforming applications must possess high toughness

Levels with adequate abrasion resistance and strength. Grades employed for metalforming applications are typically based on coarse grain sizes (3 to 8 mm) and high binder contents (15 to 30 wt. %).

Which grades are useful in earth drilling or boring applications?

In many respects the characteristics of the grades employed for earth drilling and boring represent a compromise between the characteristics that are important for metalcutting and those that
are important for metalforming applications. Grades for earth drilling and boring must possess the highest toughness levels for any given abrasion resistance level, while simultaneously possessing
adequate strength levels. The best compromise is usually arrived at by using grades that are based on
coarse grain sizes (3 to 8 mm) and relatively low Co levels (6 to 16 wt. %).

How can I choose the most suitable products for my applications?

1 Correct installation site depends on specific size and drawings. Especially for dies processing, drawings can ensure the finished products are qualified.
2. Processing objects and working environment is determined by cemented carbide grades. Products' lifetime can be greatly extend if grades are right.