Wolfram marches on

By Alan Richter, Editor

This month, CUTTING TOOL ENGINEERING covers two developments in tungsten carbide that can be used for cutting tools.

Binder begone

When is tungsten carbide not quite tungsten carbide? When it's polycrystalline.

After 6 years of R&D, Cerbide Inc. recently introduced a polycrystalline tungsten carbide material under the brand name Cerbide. Unlike traditional WC, which uses cobalt or some other binder to hold the carbide grains together, PWC does not.

"Cerbide is a homogenous material; it has no binder," said Bob Gralke, president of North American Carbide, the exclusive distributor of Cerbide cutting tools. "It makes it much harder and many more times abrasion-resistant than normal carbide."

A selection of cutting tools made from polycrystalline tungsten carbide, which has no binder, as shown in the micrograph (inset).

He said that's because a binder such as cobalt reduces carbide's hardness and abrasion resistance. "The binder, which has the lowest melting temperature, is the weakest and softest part," Gralke noted. "So being able to form pure tungsten carbide eliminates all the weaknesses." According to the manufacturer, Cerbide has a hardness of 2,400 HV, or 95.5 HRA.

On the flipside, the lack of a binder heightens Cerbide's brittleness. Gralke explained: "The strong point of cobalt as a binder is it increases toughness. So as a material gets harder and more abrasion-resistant, it loses some of its fracture toughness and that's the case with Cerbide. Is Cerbide the answer for cutting every material? Absolutely not."

However, when the workpiece and application are appropriate, such as high-speed machining of titanium, Cerbide can be just the ticket because it retains its hot hardness at elevated temperatures. "Cerbide is probably as close to being impervious to heat as you can get," Gralke said.

He added that "the hot hardness for traditional tungsten carbide drops drastically as soon as it becomes hot. In Cerbide, it remains almost the same."

With such a high level of hardness already, the coating that makes the most sense for Cerbide is diamond. Without a cobalt binder, though, it would seem that the substrate wouldn't hold a diamond coating because, usually, the cobalt is etched out in order for the diamond to adhere to the carbide grains. According to Gralke, that's not the case. "Cerbide holds a coating, specifically a chemical-vapor-deposition diamond coating, better than any WC material that's ever been made."

He told about sending a PWC tool to a diamond coater "to watch them kind of fall on their face because it didn't have any cobalt." Instead, the technician performing destructive testing to determine the coating's adhesion was unable to blast away the diamond coating. "Then he said he tried to blast the Cerbide itself, and where he'd normally go right through a carbide insert, all he could do was put a polish on it."

Of course, a diamond coating adds to the price of a Cerbide tool, which costs about three times more than a comparable WC one, so North American Carbide is working with a coating company to develop a thicker diamond-like coating "that has the hardness of the diamond coating at about 25 percent the cost," Gralke said.

When lubricity is required, Gralke said a titanium-diboride coating is effective. "That makes it extremely slippery."

Currently, Cerbide, which is also targeted toward the wear-parts market, is commercially available as inserts and endmills for cutting a variety of materials. These will eventually come in a range of grade.

For more information, contact North American Carbide, Orchard Park, N.Y., at (716) 662-0270 or visit www.northamericancarbide.com, or Cerbide Inc., Orchard Park, N.Y., at (716) 662-0274 or visit www.cerbide.com.