Demystifying 'ceramic' grits


Archives MNATP, Collection Meillassoux

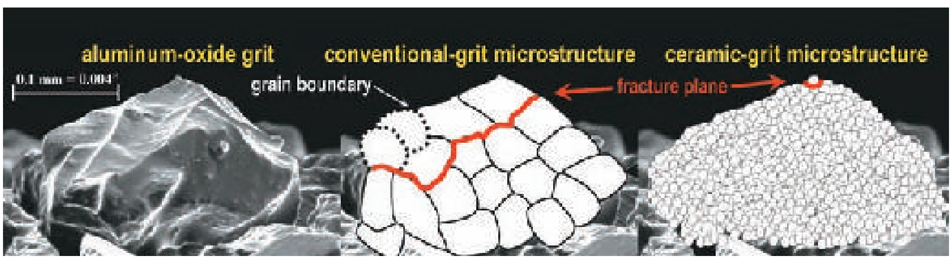
Dear Doc,

I hear ceramic grits referred to by different names. Can you explain why this is and when I should use them for fluting and threading?

The Doc replies:

"Ceramic" grits are aluminum-oxide grits that have a microstructure much smaller than conventional Al_2O_3 grits. They go by many names: SG, sol-gel, seeded-gel, sintered abrasive, ceramic abrasive, microfracturing grit and Cubitron.

Shifty salesmen will tell you a ceramic grit is a hybrid between Al_2O_3 and CBN. It's not. It's just regular Al_2O_3, with almost the same hardness but with a smaller microstructure. When a ceramic grit fractures along grain boundaries, it fractures in small pieces instead of large chunks.



J. Badger

A ceramic grit fractures into smaller pieces than a conventional Al_2O_3 grit.

Two companies produce ceramic grits: Saint-Gobain and 3M. Saint-Gobain produces the grits and then uses them in its own grinding wheels. 3M sells its products to companies that put them in their wheels. Saint-Gobain's trade name is SG and 3M's is Cubitron.

Although both SG and Cubitron fracture into small pieces, they are not produced in the same way, nor do they behave exactly the same during grinding. There is some debate about which one is better.

In addition to SG, Saint-Gobain produces TG, which is simply an elongated form of SG. Instead of having an aspect ratio of 1:1, as is the case with most abrasives, TG has an aspect ratio of 4:1 or more.

Ceramic-grit wheels are typically a mixture of 10 to 30 percent ceramic grit and 70 to 90 percent conventional Al_2O_3. It's often hard to tell by looking at the wheel whether or not it contains ceramic grit.

Based on my experience, I rate ceramic grits' effectiveness for fluting and threading as follows:

- small-diameter fluting (less than ¼"): it depends;
- medium-diameter fluting (¼" to ½"): yes;
- large-diameter fluting (greater than ½"): absolutely;
- single-rib threading with a resin wheel: yes; and
- multirib threading with a vitrified wheel: probably not.

In addition, the more difficult the material is to grind, the more benefit you'll see from ceramic grit. So, with low-alloy materials, you'll see some benefit, and with high-alloy materials, you'll see a great deal of benefit.

The price of a ceramic-grit wheel is anywhere from 25 to 700 percent higher than a conventional Al_2O_3 wheel. Most companies I know of that have tried ceramic-grit wheels tend to stick with them.

However, these wheels can be tricky to use properly. Take time to learn as much about them as you can.

Dear Doc,

I get more wheel wear when the wheel diameter becomes smaller. Why is this, and is there an easy way to figure out how much more I need to dress?

The Doc replies:

At a smaller diameter, you have several things working against you. First, if your grinding machine is running at a constant rpm, a smaller diameter means lower wheel surface speed. That means more wheel wear. Second, a smaller diameter means a shorter arc of cut, where

$$\text{arc length} = \sqrt{(\text{wheel diameter} \times \text{DOC})}.$$

This translates into more wheel wear. Third, you have a smaller wheel circumference, where

$$\text{wheel circumference} = \pi \times \text{wheel diameter}.$$

Consequently, you have less abrasive grit to do the work.

Here's a rough-and-ready way to figure out how much more you need to dress the wheel to compensate: Divide the initial wheel diameter by the final wheel diameter and then square it. That's the factor you'll use to determine how much to dress.

So, if the wheel diameter goes from 16" to 12" and you're dressing 0.002" at full diameter, then the factor is 1.78—$(16/12)^2$—and you'll need to dress about 0.0036" at the 12" diameter (1.78×0.002"). If your machine is running at a constant wheel velocity, as opposed to constant rpm, then this factor will be a little less. △

About the Author

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