sometimes the dimensional accuracy is aggravated because the block can be obliquely cut, or cutting marks by the wheel be left on the cut surface of a magnet piece. Specifically, when a cemented carbide base outer blade cutting wheel having an outer diameter of 80-200 mm, a bore diameter of 30-80 mm, and a thickness of 0.1-1.0 mm, for example, is used and operated to perform high-speed, high-load cutting at a machining volume per unit time of at least 200 mm^3/min, a dimensional tolerance may exceed 50 μm. If the dimensional accuracy is aggravated, some remedies are necessary. For example, the magnet pieces must be subjected to an additional step of precision grinding the cut surface such as by lapping. The outer blade cutting wheel must be dressed using a grinding wheel or the cutting conditions be altered.

[0010]

This becomes a barrier in the machining of magnet pieces which are suited for use in motors in which a strict management of the clearance between a yoke and a magnet is required such as linear motors and hard disc voice coil motors (VCM) and which require both a high dimensional accuracy (including the flatness of cut surface) and a reduction of manufacture cost.

[0011]

Embodiments~~An object~~ of the invention seek~~is~~ to provide a cemented carbide base outer blade cutting wheel capable of cutting a rare earth sintered magnet block into pieces having a high dimensional accuracy, and a method for preparing the outer blade cutting wheel at a low cost.

Solution to Problem

[0012]

It is presumed that a phenomenon that a rare earth sintered magnet block is obliquely cut takes place because

A void problem arises in the outer blade cutting wheel in which abrasive grains are bonded to a base by electroplating or electroless plating to form a blade section. Since the abrasive grains have a certain grain size, the bonded abrasive grains are contacted only in part between grains and between grains and the base, and voids therebetween are not completely buried by plating. As a result, voids are left in the blade section even after plating. That is, the blade section contains voids in communication with the surface.

[0015]

As long as the load applied to the outer blade cutting wheel during cutting operation is low, high accuracy cutting is possible, even in the presence of such voids, because the blade section does not undergo substantial deformation by the force applied during cutting. However, where cutting is carried out under such a high load as to cause the cemented carbide base to be deformed, the blade edge can be in part deformed or shed. An effective method for preventing the blade edge from deformation or shedding is by enhancing the strength of the blade edge. Since the blade section should have a sufficient elasticity to allow the blade section to deform to enable smooth mergence of cut surfaces as will be described later, the mere enhancement of blade strength to be resistant to deformation fails to address the problem.

[0016]

Making further investigations on the construction of the blade section that meets both high strength and elasticity and the necessary mechanical properties of the blade section, the inventors have found that an effective blade section may be~~is~~ obtained by utilizing voids between abrasive grains and between abrasive grains and the base, specifically by letting a resin infiltrate in the voids. The resin infiltrate is formed by melting a thermoplastic resin,

infiltrating and solidifying, or by infiltrating a liquid thermosetting resin composition and curing. An outer blade cutting wheel comprising a cemented carbide base and such a blade section is effective in improving the dimensional accuracy of magnet pieces cut thereby. The technique of melting a thermoplastic resin, infiltrating and solidifying or the technique of infiltrating a liquid thermosetting resin composition and curing may be~~is~~ effective for the manufacture of an outer blade cutting wheel featuring a high cutting accuracy and low cost. The invention is predicated on these findings.

[0017]

In one aspect, the invention provides an outer blade cutting wheel comprising a base in the form of an annular thin disc of cemented carbide having a Young's modulus of 450 to 700 GPa, having an outer diameter of 80 to 200 mm defining an outer periphery, an inner diameter of 30 to 80 mm, and a thickness of 0.1 to 1.0 mm, and a blade section on the outer periphery of the base,

the blade section comprising diamond and/or CBN abrasive grains pre-coated with a magnetic material, a metal or alloy bond formed by electroplating or electroless plating for bonding abrasive grains together and to the base, and a resin infiltrated between abrasive grains and between abrasive grains and the base, said resin being a thermoplastic resin having a melting point of up to 350°C or a thermoset resin obtained by curing a liquid thermosetting resin composition having a curing temperature of up to 350°C.

In a preferred embodiment, the resin is at least one member selected from the group consisting of acrylic resins, epoxy resins, phenolic resins, polyamide resins, polyimide resins, and modified resins of the foregoing. Also preferably, the resin has a Poisson's ratio between 0.3 and 0.48.

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In a preferred embodiment, the resin is at least one member selected from the group consisting of acrylic resins, epoxy resins, phenolic resins, polyamide resins, polyimide resins, and modified resins of the foregoing. Also preferably, the infiltrating resin has a Poisson's ratio between 0.3 and 0.48.

In a preferred embodiment, the base has a saturation magnetization of at least 40 kA/m (0.05 T).

In a preferred embodiment, the abrasive grains have an average grain size of 10 to 300 μm. Also preferably, the abrasive grains have a mass magnetic susceptibility χg of at least 0.2.

In a preferred embodiment, the permanent magnet produces a magnetic field of at least 8 kA/m within a space extending a distance of 10 mm or less from the base outer periphery.

Advantageous Effects of Invention

[0019]

Using the cemented carbide base outer blade cutting wheel, a rare earth magnet block is cut into magnet pieces. With only the cutting operation, the magnet pieces are finished to a high dimensional accuracy. Any finishing following the cutting operation may be omitted. Rare earth magnet pieces having a high dimensional accuracy may be~~are~~ obtained at a low cost.

The method for manufacturing the outer blade cutting wheel may be~~is~~ cost effective.

BRIEF DESCRIPTION OF DRAWINGS

[0020]