and effecting plating in this state, thereby bonding the abrasive grains to the outer periphery. The method reduces the cost of manufacture of outer blade cutting wheels.

[0009]

The cemented carbide base outer blade cutting wheel produced by the above-mentioned method is an outer blade cutting wheel featuring high performance. When a rare earth sintered magnet block is cut into magnet pieces by the wheel, 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]

EmbodimentsAn object of the present invention seekis to provide a cemented carbide base outer blade cutting wheel capable of cutting a

rare earth sintered magnet block into pieces that may havehaving 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 the outer blade cutting wheel has a blade shape which is not laterally symmetric, allowing cutting operation to proceed in a direction of easy cutting, and because the outer blade cutting wheel is warped when it is mounted on a machining tool. It is also presumed that a phenomenon that cut marks are left on magnet pieces takes place because when the outer blade cutting wheel which is cutting the magnet block obliquely for the above reason changes its travel direction abruptly on the way of cutting operation, the cut surface which is newly cut does not smoothly merge with the cut surface which has been cut, forming a step.

[0013]

An abrupt change of the travel direction of the outer blade cutting wheel during cutting operation occurs, for example, when the blade of the outer blade cutting wheel is, in part, deformed or spalled for some reason; when the blade edge abruptly changes its shape; when the blade is deformed by the feed speed of the cutting wheel which is higher than the grinding speed of the blade, the internal stress induced in the blade by that deformation becomes greater than the external force applied from the workpiece to the blade, and as a consequence, the force causing deformation of the blade is released; and when the travel of the outer blade cutting wheel is interrupted by loading or glazing of the cutting groove with sludge formed during cutting operation or foreign

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 metal or alloy infiltrate in the voids. An outer blade cutting wheel comprising a cemented carbide base and such a blade section may be~~is~~ effective in improving the dimensional accuracy of magnet pieces cut thereby. The technique of infiltrating a metal or alloy 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 metal or alloy binder having a melting point of up to 350°C infiltrated between abrasive grains and between abrasive grains and the base, wherein the abrasive grains, the magnetic material covering abrasive grains, the metal or alloy bond, and the metal or alloy binder infiltrated into voids are dispersed in the blade section.

In a preferred embodiment, the binder metal is Sn and/or Pb, and the binder alloy is at least one alloy selected from the group consisting of Sn-Ag-Cu, Sn-Ag, Sn-Cu,

In a preferred embodiment, the infiltrating metal is Sn and/or Pb, and the infiltrating alloy is at least one alloy selected from the group consisting of Sn-Ag-Cu, Sn-Ag, Sn-Cu, Sn-Zn, and Sn-Pb alloys. Also preferably, the infiltrating metal or alloy 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 beare obtained at a low cost. The method for manufacturing the outer blade cutting wheel may beis cost effective.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

[Fig. 1] FIG. 1 schematically illustrates an outer blade cutting wheel in one embodiment of the invention, FIG. 1A being a plan view, FIG. 1B being a cross-sectional view taken