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(54) **Cubic boron nitride abrasive bodies.**

(57) A tool insert comprises an abrasive compact comprising a polycrystalline mass of cubic boron nitride particles present in an amount of at least 70 percent by volume and containing substantial direct particle-to-particle bonding and a second phase dispersed through the cubic boron nitride particle mass. The abrasive compact presents major surfaces on each of opposite sides thereof. The one major surface provides a cutting point for the insert and the other major surface has bonded thereto a layer of molybdenum of thickness less than 0,5 mm. The largest linear dimension of the compact is no more than 10 mm. The tool insert is designed for applications where a high removal rate of work piece is desired.

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"CUBIC BORON NITRIDE ABRASIVE BODIES"

BACKGROUND OF THE INVENTION

This invention relates to cubic boron nitride abrasive bodies.

Cubic boron nitride abrasive compacts are known in the art and consist of a polycrystalline mass of cubic boron nitride particles present in an amount of at least 70 percent by volume bonded into a hard conglomerate. Such compacts may contain a second phase. When provided, the second phase is typically a ceramic phase. The second phase acts to some extent as a binder phase for the cubic boron nitride particles.

One of the most successful cubic boron nitride abrasive compacts presently on the market is one wherein the second phase consists essentially of aluminium nitride and/or aluminium diboride. This compact is sold in the form of large discs which are clamped into a suitable tool holder and used in this manner for abrading various work pieces. A curved edge of the compact is used as the abrading edge. This compact is designed for applications where a high removal rate of workpiece is desired.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a tool insert comprising an abrasive compact comprising a polycrystalline mass of cubic boron nitride particles present in an amount of at least 70 percent by volume and containing substantial direct particle-to-particle bonding and a second phase dispersed through the cubic boron nitride particle mass, the abrasive compact presenting major surfaces on each of opposite sides thereof, the one major surface providing a cutting point for the insert and the other major surface having bonded thereto a layer of molybdenum of thickness less than 0,5mm, the largest linear dimension of the compact being no more than 10mm.

DETAILED DESCRIPTION OF THE INVENTION

The tool insert of the invention is thus a small cubic boron nitride compact which has a molybdenum layer bonded to one major flat surface thereof. Because of its size, it is not practical to hold the insert mechanically in a suitable tool holder. However, the presence of the molybdenum layer renders the compact brazeable to a tool holder. It is preferable that the compact is first brazed to a cemented carbide support which is then brazed to the tool holder or mechanically held in a tool holder. Cemented carbide has a similar coefficient of thermal expansion to the compact and problems arising due to differences in thermal expansion of the compact and support are minimised.

The abrasive compact of the insert preferably has a rectangular, triangular, pentagonal or hexagonal shape. Thus, the compact presents several points and it is these points which provide cutting points for the insert.

The molybdenum layer is the thin layer, preferably having a thickness in the range 50 to 150 microns. The layer of molybdenum may have an outer nickel or like metal layer applied to it.

The cubic boron nitride compact may be any known in the art but is preferably one wherein the second phase contains aluminium nitride and/or aluminium diboride. Second phases of this nature are produced when aluminium is present during manufacture of the compact. One particularly preferred cubic boron nitride of this nature has a second phase which consists essentially of aluminium nitride and/or aluminium diboride. The second phase may also contain other components such as silicon which is either in elemental or combined form.

The tool inserts of the invention may be used for a wide variety of applications. They have particular application for light to medium turning, boring, grooving, threading and milling of various steels, irons and alloys such as:

Ni-HARD white irons having a hardness of 55 to 58 HRC
High chromium irons having a hardness of 55 to 62 HRC
Cold work tool steels having a hardness of 60 HRC
High speed steels having a hardness of 62 HRC
Grey cast irons (pearlitic) having a hardness of 220 HB
Sintered irons having a hardness of 100 HB
Cobalt-based hard facing alloys
Nickel-based hard facing alloys
Meehanite white irons having a hardness of 55 HRC

In all these applications the cubic boron nitride abrasive compact will be brazed to a cemented carbide support, preferably a cemented tungsten carbide support through the readily brazeable molybdenum layer and using a braze such as a silver brazing alloy having a melting point between 660°C and 840°C. The thus bonded cubic boron nitride abrasive

compact will then be held mechanically or brazed to the shank of a tool and used in this form for the various abrading applications mentioned above.

As mentioned above, the tool insert is particularly useful for light to medium cut applications. This means that the infeed of the tool insert during turning, boring, grooving or milling will not exceed 0,3mm per revolution or pass of the insert across the workpiece.

In an example of the invention, a mass of cubic boron nitride particles was placed in contact with an aluminium foil which itself was placed in contact with a foil of molybdenum. This unbonded assembly was placed in the reaction zone of a conventional high temperature/high pressure apparatus and subjected to a temperature of about 1500°C and a pressure of about 55 kilobars for a period of 15 minutes. Recovered from the reaction zone using conventional techniques was an abrasive compact containing about 90 percent by volume of cubic boron nitride particles in which there was substantial direct particle-to-particle bonding and a second phase consisting essentially of aluminium nitride and/or aluminium diboride. The compact was produced in the form of a disc and had bonded to a major flat surface thereof a layer of molybdenum of thickness about 100 microns. This compact was cut into a plurality of equilateral triangles, some having a side dimension of 5mm and others having a side dimension of 7mm. Each triangle constituted a tool insert of the invention.

The triangular-shaped inserts produced in this manner were found to be excellent for the boring of pearlitic grey cast iron, for the facing of Stellite 6 hard facing alloy and the threading of Ni-HARD white cast iron. The particular conditions used in each example are given below.

EXAMPLE 1 - BORING

Material	Pearlitic grey cast iron
Hardness	220 HB
Speed	600m/min
Feed	0,2mm/rev
Cut	0,5mm
Coolant	None

EXAMPLE 2 - FACING

Material	Stellite 6 hard facing alloy
Hardness	30 HRC
Speed	200m/min
Feed	0,2mm/rev
Cut	0,5mm
Coolant	None

EXAMPLE 3 - THREADING

Material	Ni-HARD white cast iron
Hardness	58 HRC
Speed	40m/min
Thread form	ISO M16
Radial infeed	0,1mm/pass
Coolant	None

CLAIMS

1.

A tool insert comprising an abrasive compact comprising a polycrystalline mass of cubic boron nitride particles present in an amount of at least 70 percent by volume and containing substantial direct particle-to-particle bonding and a second phase dispersed through the cubic boron nitride particle mass, the abrasive compact presenting major surfaces on each of opposite sides thereof, the one major surface providing a cutting point for the insert and the other major surface having bonded thereto a layer of molybdenum of thickness less than 0,5mm, the largest linear dimension of the compact being no more than 10mm.

2.

A tool insert according to claim 1 wherein the second phase contains aluminium nitride and/or aluminium diboride.

3.

A tool insert according to claim 1 or claim 2 wherein the second phase contains silicon in elemental or combined form.

4.

A tool insert according to any one of the preceding claims wherein the thickness of the molybdenum layer is in the range of 50 to 150 microns.

5.

A tool insert according to any one of the preceding claims wherein the compact has a triangular, rectangular, pentagonal or hexagonal shape .