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(54) **Abrading method**

(57) A diamond abrasive compact is used for abrading a workpiece in a corrosive environment. The invention has particular application to abrading wood prod-

ucts which contain resins or organic binders. The diamond abrasive compact is characterised by a second phase which comprises chromium and nickel.

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Description

BACKGROUND OF THE INVENTION

This invention relates to an abrading method and more particularly a method of abrading a workpiece in a corrosive environment.

Abrasive compacts are well known in the art and are used extensively in industry for the abrading of various workpieces. They consist essentially of a mass of abrasive particles present in an amount of at least 70 percent, preferably 80 to 90 percent, by volume of the compact bonded into a hard polycrystalline conglomerate. The abrasive particles are either diamond or cubic boron nitride.

Abrasive compacts may be used on their own or bonded to a suitable substrate. The substrate will generally be a cemented carbide substrate.

Diamond abrasive compacts have been used in a wide variety of abrading operations. These compacts may be produced using a second phase or bonding matrix which often contains a solvent/catalyst suitable for synthesising diamond. One such compact is described in EP 0 198 653. This compact is characterised by a second phase or bonding matrix which contains chromium and a second metal selected from the group nickel, iron and cobalt. The chromium is present in the form of the metal, chromium carbide and/or in the form of an intermetallic compound with the second metal. The second metal is present in the form of the metal and/or the intermetallic compound referred to above. In particular, the compact is useful in dressing tools or surface set drill bits. The abrasive compact is used and is not supported by a cemented carbide substrate.

Diamond abrasive compacts have been used in the abrading, e.g. cutting, of wood products. The hardness and abrasion resistance of a diamond compact are properties which are very useful in this application. The wood or wood products may contain resins and a whole range of organic binders which remain on the diamond table and have to be cleaned with corrosive cleaning products that leach the cobalt binder before EDM re-sharpening can commence. The loss of cobalt binder leads to undercutting when the cutting edge is EDM sharpened. This in turn leads to chipping of the cutting edge.

SUMMARY OF THE INVENTION

According to the present invention, a method of abrading a workpiece in a corrosive environment includes the steps of providing a diamond abrasive compact as hereinafter defined, having a cutting edge or point, providing a workpiece, bringing the point or edge of the diamond abrasive compact into contact with the workpiece and advancing the edge or point into the workpiece in an abrading manner.

The diamond abrasive compact which is used in the

invention is one which is a polycrystalline mass of diamond having a second phase comprising chromium and nickel, the diamond content of the compact comprising at least 70 percent by volume of the compact. Preferably the second phase consists of chromium and nickel with any other components being in trace amounts only. It has been found that such diamond compacts have excellent corrosion resistance, particularly in environments in which there is present binder and/or corrosive cleaning chemicals.

In the method of the invention, the cutting point or edge on the compact is advanced into workpiece with an abrading action. Abrading in the context of the specification means cutting, drilling, routing, polishing, or any similar such abrading action. This action may take various forms, known in the art, such as rotation of the cutting edge or point, reciprocating movement of the cutting edge or point or the like. Of course, the abrading action can also be achieved by maintaining the edge or point stationary and moving the workpiece.

The invention provides, according to another aspect, the use of a diamond abrasive compact as defined above in a method of abrading a workpiece in a corrosive environment.

DESCRIPTION OF EMBODIMENTS

The diamond abrasive compact of the invention is one which is characterised by the second phase comprising chromium and nickel. The mass ratio of chromium to nickel metal will typically be 10:90 to 25:75. In the second phase, the chromium and nickel will both exist in the form of the metal, in the form of carbides and/or in the form of an intermetallic compound of the chromium and the nickel.

The diamond abrasive compact has been found to have excellent corrosion resistance in environments in which there is present binder and/or corrosive cleaning chemicals.

The diamond abrasive compact may be bonded to a cemented carbide substrate or to a metal layer base such as molybdenum, tantalum or tungsten.

Thus, the invention has been found to have particular application in the abrading of products which contain wood. Examples of wood products are natural wood, either soft or hard wood, laminated and non-laminated chipboard and fibreboard, which contain wood chips or fibre bonded by means of binders, hardboard which is compressed fibre and sawdust and plywood.

The wood products may have plastic or other coating applied to them. Some of these wood products may contain resins and organic binders. It has been found that the presence of the corrosive cleaning chemicals and/or binder does not result in any significant undercutting of the cutting edge or point of a diamond abrasive compact as described above, leading to a much lower incidence of chipping. The abrading may take the form of sawing, milling or profile cutting. The tools which are

used in such applications are generally multi-tip rotary tools such as circular saws, profile cutters, end mills, milling cutters and routers.

An example of a method of producing a diamond abrasive compact containing a nickel/chromium second phase will now be described. A mass of diamond particles (16,0g) was placed in a tantalum cup. A disc (2,6g) of a nickel/chromium alloy was placed on top of the mass of diamonds. Thus, the mass ratio of nickel/chromium was 80:20. The nickel/chromium constituted 14 percent by mass of the contents of the loaded tantalum cup.

The loaded cup was placed in the reaction zone of a conventional high temperature/high pressure apparatus and subjected to 1500°C temperature and 5,5GPa (55 kilobars) pressure and these conditions were maintained for a period of 10 minutes. Recovered from the reaction zone was a disc-shaped abrasive body which comprised a polycrystalline mass of diamond particles having a second phase containing chromium and nickel, as metals and in various combined forms, uniformly distributed through the diamond mass.

7. A method according to any one of claims 4 to 6 wherein the wood product contains a resin or organic binder.

5 8. A method according to any one of the preceding claims wherein the abrading is selected from cutting, drilling, routing and polishing.

Claims

1. A method of abrading a workpiece in a corrosive environment includes the steps of providing diamond abrasive compact having a cutting edge or point, the compact being a polycrystalline mass of diamond having a second phase comprising chromium and nickel and the diamond content comprising at least 70 percent by volume of the compact, providing a workpiece, bringing the point or edge of the diamond abrasive compact into contact with the workpiece and advancing the edge or point into the workpiece in an abrading manner.
2. A method according to claim 1 wherein the second phase of the diamond abrasive compact consists of chromium and nickel.
3. A method according to claim 1 or claim 2 wherein the mass ratio of chromium to nickel is in the range 10:90 to 25:75.
4. A method according to any one of the preceding claims wherein the workpiece is a product which contains wood.
5. A method according to claim 4 wherein the wood product is selected from natural wood, laminated and non-laminated chipboard and fibreboard, hardboard and plywood.
6. A method according to claim 4 or claim 5 wherein the wood product has a plastic or other coating applied to it.