Abstract

The present invention is particularly to Tungsten Carbide as tool insert with 24 hours holding time of cryogenic treatment for performing turning operation on carbon steel EN8 round bars.

Cryogenic processing has become a widely used heat treatment technique for a number of products, including industrial cutting tools, automotive brake and engine system components. Deep cryogenic treatment of tungsten carbide tool inserts gives better tool life during machining process. Cryogenic treatment or cryo treatment was done on Tungsten Carbide cemented insert for 24 hours. Then the inserts were then tempered at 200°C for 2 hours. The Vickers Micro-hardness for the insert was determined. The hardness value for cemented carbide untreated insert was 1493.8 hv. The turning tests were conducted for EN8 round bars at four different cutting speeds 80 m/min., 100 m/min., 120 m/min. and 140 m/min. and four different feed rates 0.05mm/rev, 0.10mm/rev, 0.15mm/rev, 0.20mm/rev and four different depth of cut rates 1.4mm, 1.6mm, 1.8mm and 2mm respectively. The inserts were studied for wear, after the machining process was completed by using an optical microscope. The microstructure images for the cryo treated inserts were studied with the help of the scanning electron microscope.

The 24 hour cryo treated inserts with the cutting speed of 80m/min and depth of cut 1.4mm was found to have produced the least tool wear. The particles formed in the 24 hours cryo treated inserts were found to be denser and larger, and the matrix was found to be coherent and much tougher. With the cryogenic treatment, coarser and randomly distributed particles had refined into the most stable and fine particles. Also, the Vickers Micro-hardness was determined for the tungsten carbide 24 hour cryo treated insert to be 1868 hv. Thus, the Micro-hardness value for the cryo treated tool insert had increased by 20%, thus providing it low tool wear and low surface roughness.

5. CLAIMS

We claim

A cutting tool insert having low wear rate and high micro-hardness at an optimum holding rate of 24 hours and with an optimum depth of cut 1.4 mm and tool run at 80 m/min.

Dated this...18th...day of May, 2015

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Patent Application no:	**Sheet no:1**

FIGURE NO. 1

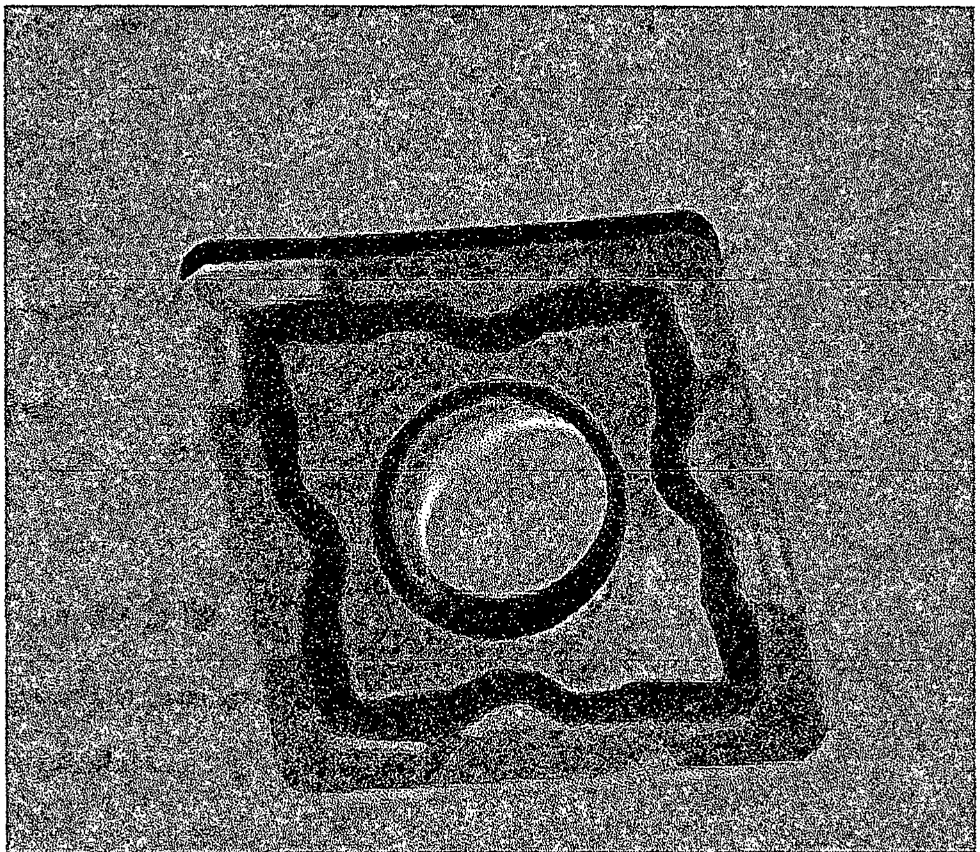

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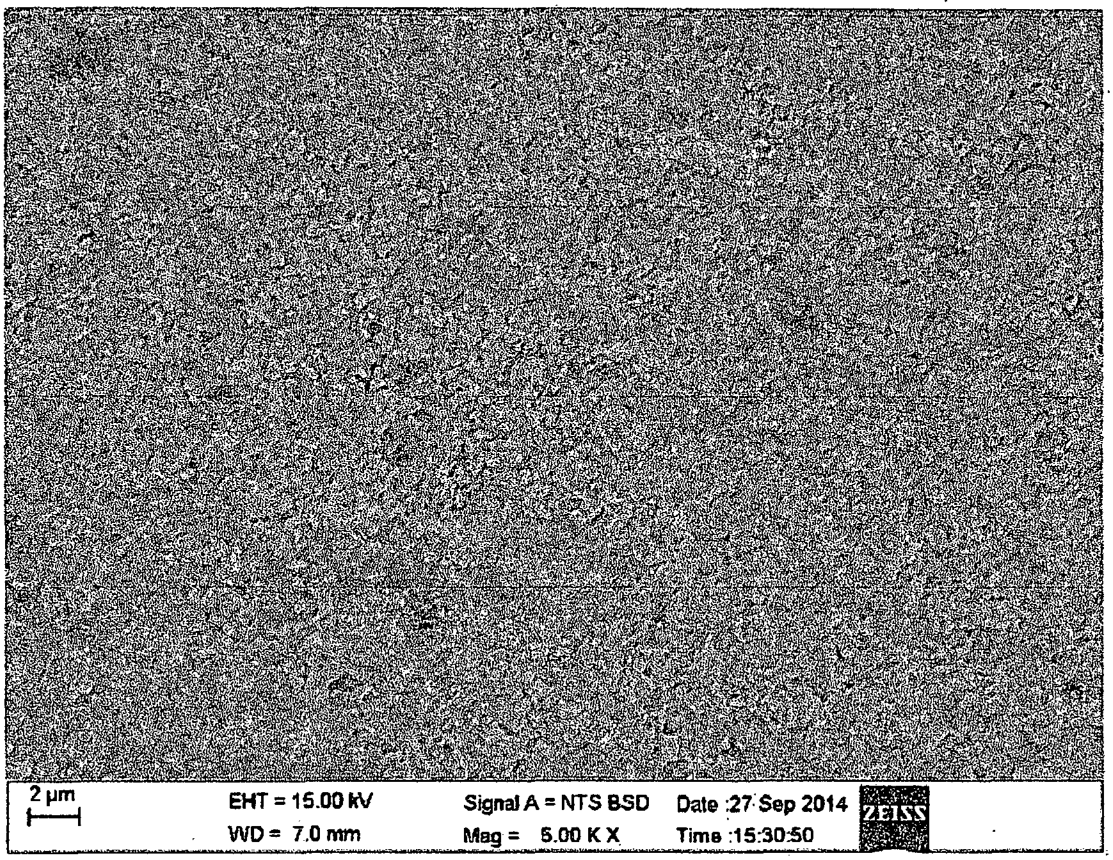
FIGURE NO. 2



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4. DESCRIPTION

Field of Invention

The present invention is related generally to Tungsten Carbide as tool insert material and more particularly for performing turning operation of EN8 round bars at the 24 hours holding time for cryogenic treatment.

Related Prior Art

In a known cutting tool of this type (EP0263747 A1), a surface coated tungsten carbide-base sintered hard alloy material is used for inserts as cutting tool which exhibits an excellent cutting performance by virtue of excellent wear resistance and toughness thereof, when used not only in continuous cutting of steel but also in intermittent cutting of same. In a known cutting tool of this type (EP0251264 A1), the invention relates to a diamond-coated tungsten carbide-base sintered hard alloy material for inserts of cutting tools, which has greatly improved bond strength or degree of bonding of the diamond coating layer to the matrix and therefore is capable of exhibiting excellent cutting performance over a long period of time.

In another known cutting tool of this type (US4812370 A), A surface coated tungsten carbide-base sintered hard alloy material for inserts of cutting tools having excellent wear resistance and toughness comprising of a substrate having an internal portion consisting essentially of 5-30 percent by weight of one composite metal carbo-nitride, as a compound forming a hard dispersion phase, selected from the group consisting of (Ti, W)CN, (Ti, Nb, W)CN, (Ti, Ta, W)CN, and (Ti, Nb, Ta, W)CN; 4-10 percent Co as a component forming a binder phase, and the balance of WC as a component forming the hard disperse phase and inevitable impurities; the substrate having a surface portion formed with a Co-enriched layer being substantially free of the composite metal carbo-nitride; and also of a hard surface layer coated over the surface of the substrate, comprising an innermost layer consisting essentially of TiC, the innermost layer containing one of a W component and W and Co components diffused from the substrate; a diffusion preventing layer formed by one of a single layer of one compound selected from the group consisting of TiCN and TiN, or a double layer of both of the components TiCN and TiN; an inner layer consisting essentially of TiC, the diffusion preventing layer preventing diffusion of one of the W component and the W and Co components into said inner layer; and an outer layer formed by one of a single layer of one compound selected from the group consisting of TiCO, TiCNO, and Al_2O_3 and a double layer of two compounds selected from same. In another known cutting tool

(US4497874 A), A coated carbide insert has a cobalt enriched zone at one decarburized surface, and a thin TiN transition layer over this surface. The cobalt enriched zone and the TiN layer cooperate to support additional thicker layers of hard wear resistant material such as TiC, TiN, and Al2 O3.

Objective of the Invention

It is an object of the present invention to provide a cutting tool insert which has low wear rate and high micro-hardness.

Advantages of the invention

In the present scenario cutting tool inserts are bound to decline in their function due to high wear rate and low micro hardness.

According to this invention, it provides the following advantages

- ✓ Wear rate of tool insert is low
- ✓ Micro hardness of the tool insert is high

Detailed description of the invention

Construction:

Medium strength EN8 carbon steel bars with a width of 36 mm and length of 76 mm were used for turning operation. The tool insert were cryogenically treated and the tool inserts were progressively cooled to -196°C by employing a computer controller with regular intervals at a rate of 0.5°C/min. The tool insert were maintained at 24 hours holding time for cryogenic treatment. Then, the temperature was gradually increased to 200°C for 2 hours to reduce the formation of residual stresses.

Operation:

The steel treated tool inserts were checked for its vickers's hardness test. Due to the cryogenic treatment, a high value of micro-hardness of the insert was found to be 1868 hv at the 24 hours holding time. For the turning operations conducted, the tool was run at 80 m/min, 100 m/min, 120 m/min and 140 m/min cutting speeds to provide a depth of cut of 1.4mm.

The microstructures of the 24 hour treated carbide inserts were studied. Fine carbide particles had formed along and they were found to be denser, with a more coherent matrix. The cryogenic treatment had formed precipitation of eta carbide particles.

Brief description of the accompanying drawings

Figure 1 and **Figure 2** shows the construction of the present invention

Description of parts in Figure 1

PHOTOGRAPHIC IMAGE OF CRYOGENIC TREATED TOOL INSERT WITH 24 HOUR HOLDING RATE WITH DEPTH OF CUT OF 1.4 mm AND TOOL RUN AT 80 m/min

Description of parts in Figure 2

SCANNING ELECTRON MICROSCOPE IMAGE OF A TREATED INSERT OF 24 HOUR HOLDING RATE WITH DEPTH OF CUT OF 1.4 mm AND TOOL RUN AT 80 m/min