NASA TECH BRIEF

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Sintered Diamond Compacts Using Metallic Cobalt Binders

The problem:

Tungsten carbide or carbonado is one of the recent products of diamond compact synthesis. Although this material is hard (1700 kg/mm^2), it is not simple to produce.

The solution:

A method has been developed for sintering diamond powder which uses metallic cobalt as a binder. Present samples show maximum microhardness of over 3000 kg/mm^2 on the Knoop scale.

How it's done:

The starting materials are diamond powder of either 0-3 μm or 10-20 μm size and cobalt powder of 0-5 μm size and 99.9+% purity. These powders are dried, weighed, and mixed, and then packed into tantalum containers for sintering.

The samples are heated by means of an internal graphite heater to 1590°C with the pressure maintained by a piston cylinder at 62x10^8 N/m^2 (900,000 psi). This condition is maintained for about 20 minutes after which the samples are cooled to room temperature for about one hour. During the cooling, pressure is slowly released to minimize the residual strains in the samples.

The best samples obtained show microhardness of 3000 kg/mm^2 on the Knoop scale and contain 20% cobalt by volume and diamond particle sizes of 0 to 3 μm. This material may be used as a hard surface coating or may compete with cubic boron nitride as an abrasive grain.

Note:

1. Further studies are being conducted to determine if the material could be produced in large sections. In addition, other binder combinations are considered instead of cobalt to possibly reduce the temperature and pressure conditions needed for formulation.

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Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457(f)], to the University of California, Los Angeles, California 90024.

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