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Rapid Polishing and Shaping of Diamond and Diamond Films

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Reference: Diamond Polishing

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Reference

- Y. Tzeng, J. Wei, C. Cutshaw, and T. Chein, "Rapid Smoothing of CVD White Diamond by Liquid Metal Films," Proceedings of the 3rd International Conference on the Applications of Diamond and Related Materials, NIST, Washington, DC, 1995, pp. 241-248.

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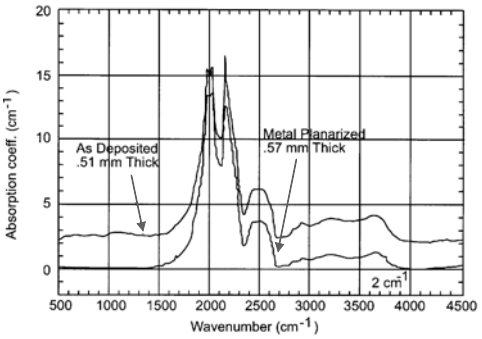
Overview

Auburn University seeks a licensee or development partner to commercialize a patented process that can efficiently polish diamond surfaces and films. Chemically grown diamond surfaces usually possess high surface roughness that are undesirable for industrial applications. This invention greatly shortens diamond polishing times with reduced diamond loss as opposed to other common techniques which use either liquid metal or rotating metal discs for smoothing.

Advantages

- Uses simple and economical equipment without any moving parts
- Removes material at a very high rate (up to 360 microns/hour) compared to existing commercial techniques (1 micron/hour)
- Reduces the loss of expensive diamond substrate with no material degradation
- Shapes diamond surfaces without using cutting tools
- Efficiently polishes complex diamond surfaces



FTIR absorption spectra indicating no degradation after polishing

Description

Industrial diamond is a very important material and is artificially grown using a wide variety of chemical vapor deposition techniques. Diamond deposition usually involves dendritic growth of polycrystalline grains resulting in substantial surface roughness. The Auburn invention quickly smoothens diamond surfaces by placing the surface in contact with a hot metal plate in a hydrogen environment. The metal plate reacts with the carbon present in the surface peaks to form liquid metal carbides, which are periodically removed to produce rapid smoothening of the surface.

An extremely high rate of diamond polishing can be achieved by this process. Unlike competing methods, this process ensures that diamond removal is from surface peaks only, thereby limiting diamond loss. The invention also offers advantages in the shaping of diamond substrates: etched or shaped metal plates may be used to impart different shapes to the diamond surface. For some applications this eliminates the need for machining diamond surfaces, which is slow and expensive.

This process very quickly brings down surface roughness to micron levels without material degradation, and is ideal for applications desiring surface roughness of 1-5 microns. It can also prove effective for applications which require very low surface roughness (10-50nm), such as optical windows. For these cases, a two-stage polishing process can be designed where the subject invention can be used to quickly bring surface roughness down, followed by other expensive techniques such as ion-beam polishing, thereby reducing the need for the more expensive method.

Status

- United States Patent Number 6,284,315
- This invention has been successfully verified by laboratory experiment

Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing
- Joint development opportunities include funded research or a joint venture