



1 Diamond cutting beads

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3D SCREEN PRINTING OF DIAMOND TOOLS WITH MULTIDimensionALLY SCALABLE CUTTING PARTICLE LOADING

Within the scope of a project of the BMBF funding program „KMU innovative - production technology“, the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Dresden, in cooperation with the company DIABÜ and other partners, has developed a patented process suitable for mass production that enables the production of scalable diamond tools in high quantities.

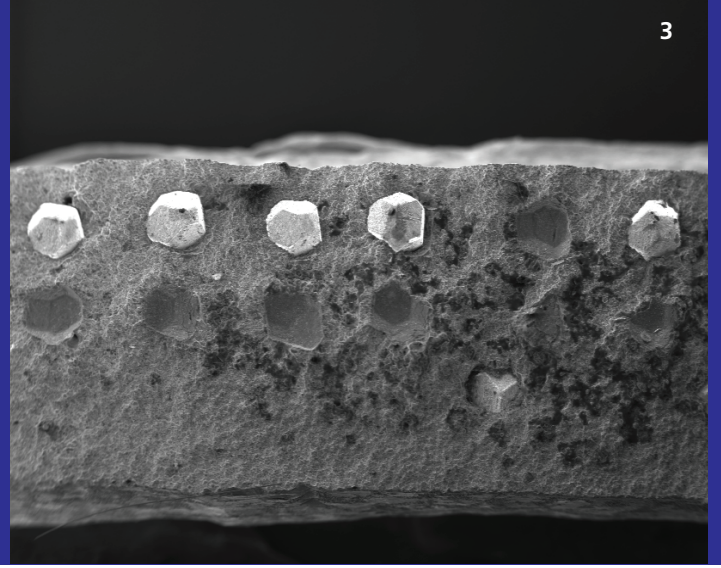
Thus, the process is clearly distinct from the conventional diamond tool production and the current approaches in additive manufacturing,

The advantages are:

- Definition of cutting particle position in the cutting tool
- Scalability of cutting particle loading
- Simultaneous production of several cutting tools
- Structuring down to μm range
- Use of different material systems in the cutting tool
- High aspect ratio
- Very high reproducibility
- Suitable for large-scale production

Patented in co-
operation with
DIABÜ®
Diamond Tools
Heinz Büttner
GmbH





- 2 *Cutting tools in print with diamond filling*
- 3 *Defined arrangement of cutting particles*

Technology

Powder-technological process

- Manufacturing of a mixture of binder matrix and organic binder material
- Layered application by screen / stencil printing to produce the three-dimensional component / cutting particle structure
- Definition of cutting particle positions in every layer
- Scaling of diamond loading through layout changes
- Heat treatment adapted to the binder matrix

Applications

- Cutting and grinding of natural stone
- Cutting and grinding of building materials
- Transfer applications to other product sectors

Material Systems

- Steel / steel alloys
- Copper / copper alloys
- Hard metals
- PM sintered / light metals
- Oxide material
- Diamonds

Application Example

In cooperation with DIABÜ, Fraunhofer IFAM has developed the procedure patented by both partners for the manufacture of diamond tools using the example of a cutting bead for diamond wire saws, which has been demonstrated in its application. For the production of respective tools with spatially defined, arranged cutting particles, a manufacturing concept has been developed for the three-dimensional screen printing process. With these new cutting tools as well as their ordered diamond particle distribution, a scalable, customizable and further improvable structuring of cutting beams could be developed for the indicated applications. The most innovative aspect is the defined positioning of the diamonds in the cutting body by means of a mass production process. An exact reproducibility of the cutting geometry and the cutting characteristics of the tools could be ensured as well as a scalability to different tool geometries demonstrated. Investigations on the influence and the selection of the raw materials,

parameters and printing tools required for the 3D screen printing process as well as the application behavior of cutting tools from one test production complemented the achieved development target. In order to show the practical reference to industry, diamond saw wires were made as demonstration tools from the prototypes and tested in comparison to the established diamond tools.

Customer Benefits

The 3D screen / stencil printing is a precise, variable and cost-efficient process for mass production of diamond tool components with scalable cutting particle loading.

Advantages:

- Suitable for large-scale line production
- Variable geometry adjustment by layout changes
- High material diversity
- Scalable cutting particle loading
- Unique 3D-Net-Shape technology

