Invitation to the second DIPLAT open meeting

December 8th 2015, 13:00 – 18:00

Ultrafast meets ultrahard
Pulsed laser ablation technologies for ultrahard tooling

Abstracts

DIPLAT: Enabling Advanced Functionalities of Diamond and Other Ultra-hard Materials by Integrated Pulsed Laser Ablation Technologies

Maximilian Warhanek, Institute for Machine tools and Manufacturing (IWF), ETH Zurich

Diamond and other ultra-hard materials (e.g. cubic boron nitride) possess outstanding mechanical, wear and thermal properties that make them attractive to manufacture a wide range of high value-added products such as high-performance, smart tooling. However, due to the extreme properties of this group of materials, efficient and precise generation of complex 3D freeform geometries and structures to meet the needs for further development of high-performance tools is still a challenge.
DIPLAT addresses the need for an efficient, precise and flexible processing technology for ultra-hard materials in tooling applications, in order to fully exploit the potential of these materials. By smartly utilizing the developments of high brilliance short and ultra-short pulsed lasers, a tooling technology based on 3D Pulsed Laser Ablation (PLA) will be developed and demonstrated for various industrial applications. The DIPLAT project will introduce a whole new technology platform for producing ultra-hard tools with enhanced functionality, outstanding machining performance and superior life-time. Its findings will mark a cornerstone with regards to a breakthrough in novel tooling technology and thus push European high value-added manufacturing industries to the cutting edge of high-performance machining and tooling technology.

New Perspective for Metallographic Grinding on Laser-shaped Abrasive Surfaces

Thomas Norbygaard, Struers

Yuchen Zhou, Machining and Condition Monitoring Group, University of Nottingham

Modern grinding consumables for metallography often consist of industrial diamond abrasives either metal plated or bonded in a resin matrix. The effectiveness of such surfaces is characterized by the inherent limits in the bonding strength and structure as well as the randomness introduced via the distribution and orientation of diamonds. Such limitations become a thing of the past as laser ablation of solid diamond allows for design of abrasive micro surfaces with completely new attributes. Sharper cutting edges and well defined wear characteristics leads to faster grinding, with less force and improved lifetime of the abrasive surface.

State of the Art Conditioning of Diamond Dressing Tools vs. Conditioning with Laser Ablation – a Comparison

Florian Hänni, Reishauer AG

Reishauer is today the world's leading manufacturer of gear grinding machines and the corresponding tooling devices with customers all over the world, mainly in the automotive industry. The customers produce high-efficient and high-precision ground gears with the Reishauer gear grinding machines. To achieve a reliable generation grinding process, the dressing of the worm grinding wheel has great importance. Electroplated diamond dressing tools are used for the dressing process. Thereby the dressing tool transfers its geometrical profile to the worm grinding wheel and through the generation grinding process to the ground gear.

The state of the art conditioning process to give the electroplated positive diamond dressing tool its final shape is a diamond on diamond grinding process, the "conventional conditioning process". This process is highly developed and has a significant influence on the ground gear. Within the DIPLAT project dressing tools were conditioned with laser ablation processes utilising ultra-short pulses. The performance of this laser conditioned dressing tools was compared with conventionally conditioned dressing tools with the focus on tool profile geometry, geometry of the grounded gear, the dressing forces and the wear

Applications for Super-hard and Ultra-hard materials

Chris JH Wort, Element Six Group, De Beers Group of companies

Synthetic diamond (in its various formats) is really the only "ultra-hard" material currently used for industrial applications. The largest current application area for synthetic diamond is as a super-abrasive in markets which are expanding as new, "difficult to machine" materials (such as CFC and MMC materials) become more widely used. The advent of CVD diamond technology has opened up a vast and diverse range of new applications beyond machining and wear-parts. Cubic boron nitride (in its various formats), is a truly "super-hard" material which currently compliments diamond in abrasive markets due to its ability to very effectively, precision machine ferrous-based materials. Unlike diamond, cBN and PCBN are currently only commercially produced by HPHT techniques for abrasive applications.

This presentation not only describes the unique combination of properties available in diamond-based and cBN-based materials, but also the major current applications for diamond and cBN including those making use of properties beyond simply their exceptional hardness.

About DIPLAT

DIPLAT is a collaborative, demo-targeted research project which shall mark the cornerstone of a new tooling technology. It will introduce a whole new technology platform for producing ultra-hard tools with enhanced functionality, outstanding machining performance and superior lift-time. By smartly utilizing the developments of high brilliance short and ultra-short pulsed lasers, a tooling technology based on 3D Pulsed Laser Ablation (PLA) will be developed and demonstrated for various industrial applications. DIPLAT

Program

13:00 – 13:15 **Welcoming speech**
Prof. D. Axinte, University of Nottingham

13:15 – 14:00 **DIPLAT: Enabling Advanced Functionalities of Diamond and Other Ultra-hard Materials by Integrated Pulsed Laser Ablation Technologies**
M. Warhanek, IWF, ETH Zurich

14:00 – 14:45 **New Perspective for Metallographic Grinding on Laser-shaped Abrasive Surfaces**
Thomas Norbygaard, Struers
Yuchen Zhou, MCM, University of Nottingham

14:45 – 15:00 **Coffee break**

15:00 – 15:45 **State of the Art Conditioning of Diamond Dressing Tools vs. Conditioning with Laser Ablation – a Comparison**
Florian Hänni, Reishauer AG

15:45 – 16:30 **Applications for Super-hard and Ultra-hard materials**
Chris JH Wort, Element Six Group, De Beers Group of companies

16:30 - 18:00 **Networking Apéro**
Sponsored by Swiss Photonics

DIPLAT open meeting:

Ultrafast meets ultrahard

Tuesday 8th of December 2015, 13h-18h

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