Enabling advanced functionalities of Diamond and other ultra-hard materials by Integrated Pulsed Laser Ablation Technologies

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DIPLAT

Diamond Integrated Pulsed Laser Ablation Technologies

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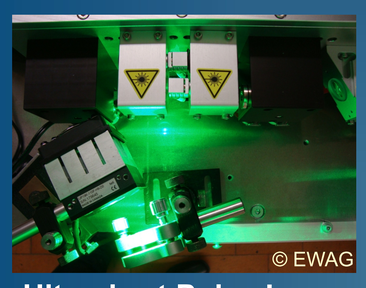
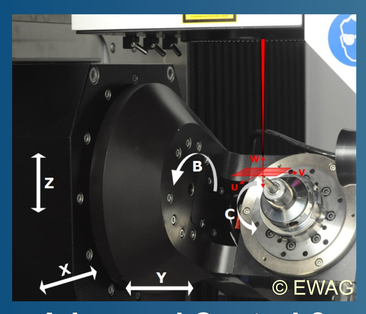
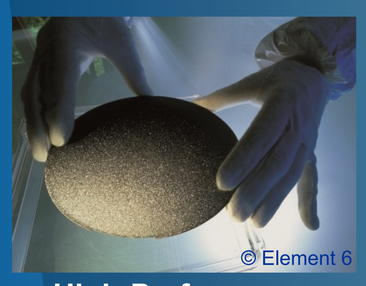


Ultrashort Pulse Laser Technology



Advanced Control & Synchronisation



High-Performance Diamond Materials

Micro & Meso Cutting Diamond Tools

Fine Grinding & Polishing Discs

Diamond Dressing & Grinding Tools

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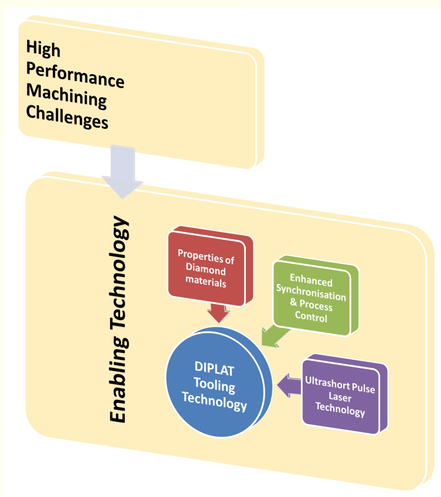
Project Facts

DEMO-targeted **collaborative project**; Participating countries: **CH, GER, DK, FR, IRL, UK;** Kick-off: **January 15th, 2013**; Duration: **42 months**; Total Budget: **5,080,634 EUR**

Motivation

Modern production systems and manufacturing environments in several key industrial sectors (e.g. automotive, aerospace, medical engineering) have an ever increasing need for **high-performance machining processes**. This presents new challenges, not only for the development of machine tools and components, but more importantly for the development of the tools utilised in these processes. **Diamond and other ultra-hard materials** possess outstanding mechanical 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** is still a big challenge.



Technology & Objectives

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 utilising 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.

- Design functional surfaces on diamond and other ultra-hard materials to enable enhanced functionality for tooling applications
- Advanced 3D laser processing strategies for ultra-hard tool surfaces
- Multi-axis control concept and a model-based CAM software support module to enable optimised 3D pulsed laser processing
- Fabrication of prototype tools and demonstration of their performance and functionality in real industrial applications

Consortium

- **2 RTD Performers:** *(Laser Ablation Fundamentals)*

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich — Coordinator, WP2 Leader (CH)

The University of Nottingham UNITED KINGDOM · CHINA · MALAYSIA — WP4 Leader (UK)

- **3 Key Technology Holders:** *(Materials & Technology)*

elementsix — WP8 Leader (IRL)

WALTER KÖRBER SOLUTIONS / EWAG KÖRBER SOLUTIONS — WP5 Leader (GER, CH)

ZEEKO Ltd — WP3 Leader (UK)

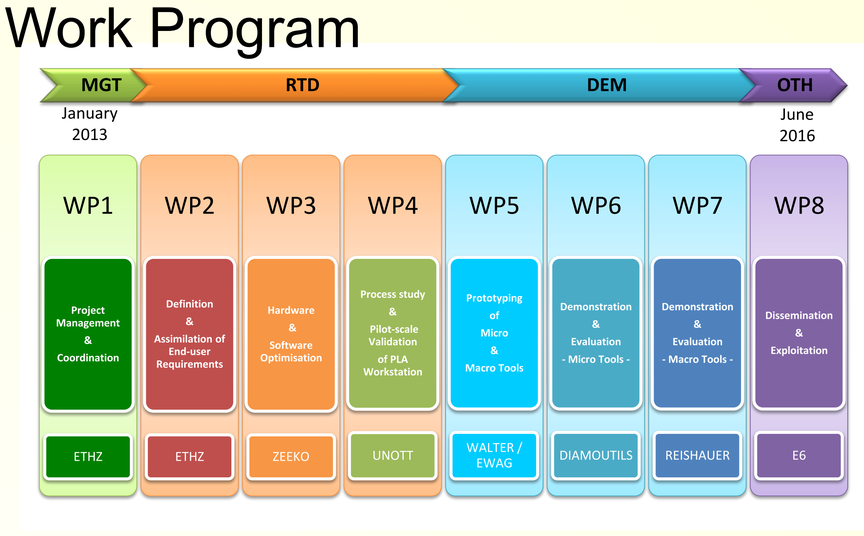
- **3 Technology End-users:** *(Tooling & Application)*

Diamoutils PRECISION DIAMOND TOOLS — WP6 Leader, (FR)

Struers — WP6 Partner, (DK)

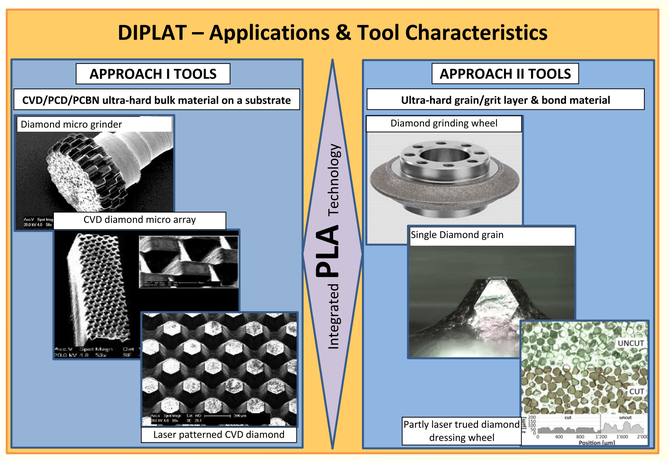
REISHAUER Gear Grinding Technology — WP7 Leader, (CH)

Work Program



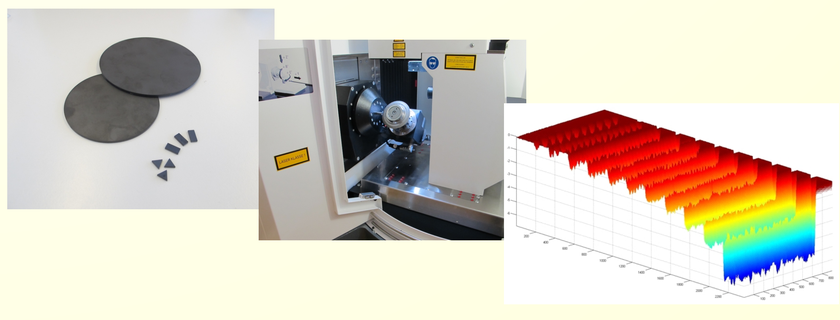
Target Applications

- Micro and meso ultrahard cutting tools (e.g. mills, micro drills) for machining difficult-to-cut materials (ceramics, CFRP, composites)
- Fine grinding and polishing discs for materiallographic preparation and surface finishing
- Diamond dressing and grinding wheels for profile and gear grinding applications



Recent results

- Database of end-user requirements, target geometries and materials for laser tooling technology demonstration
- Installation of experimental setups and machinery for developing the laser process
- Study of material response, validation of ablation model and fabrication of initial tool features



Outlook

- Development and Fabrication of generic prototype tools
- Preliminary tool performance assessment
- Implementation of advanced synchronisation concept

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FP7-2012-NMP-ICT-FoF - «Factories of the Future»
FoF.NMP.2012-7 - New technologies for casting, material removing and forming processes

SEVENTH FRAMEWORK PROGRAMME