DIAMOND MACHINING
Ultra-precision machining with monocrystalline diamond tools (diamond machining) is a key technology for the production of optical surfaces with extremely high precision. The high quality of the diamond tools in conjunction with ultra-precise machine technology enables the production of workpieces with optical surface quality and structure details with submicron precision.

**Markets**
- Optics
- Displays and lighting technology
- Tooling (plastic injection molds) for optics
- Metrology and sensors
- Biological and medical applications
- Laser technology
- Photovoltaics
- Jewelry

**Our services**
- Machining of metal and plastic optics
- Production of ultra-precision components for micro systems and metrology
- Manufacturing of structural details of less than 5 μm over large areas up to 1 m²
- Feasibility studies and prototype manufacturing
- Production of freeform optics

**Our skills**
- Holistic examination of the diamond machining process including machine design, machine characterization and machining of ultra-precision workpieces
- Mapping of the entire production process: optical design, diamond machining of tool masters and molds, plastic replication
- Application of diverse analysis methods, from optical measurement techniques up to the examination of workpieces in our large-chamber scanning electron microscope
- Timely and flexible implementation of custom solutions and prototypes thanks to high level of customer orientation
- Experience with long-term machining processes with continuous machining times of more than a week
- Use of our specially developed solutions for automated workpiece and tool exchange, accurate to the submicron
- Application of our expertise in the field of machine characterization to quality assurance in diamond machining
Our processes

At the Fraunhofer IPT, diamond machining processes are carried out on both self-developed and commercially available ultra-precision machine tools. Through the combined use of these ultra-precision machine tools, a wide product range can be manufactured using diamond machining processes such as turning, milling and planing. Furthermore, the use of highly dynamic additional axes, so-called fast tool servo systems (FTS), enables the production of non-rotation-symmetrical surfaces.

- Diamond turning
- Fast tool turning
- Fly-cutting
- Diamond milling
- Ultra-precision planing

Our materials

In addition to non-ferrous metals, which are typically used for diamond machining, the Fraunhofer IPT examines and qualifies innovative materials for the production of optical surfaces and microstructures. In an in-house plating facility, nickel-phosphorus coatings are produced for diamond machining high-quality products for optical applications.

- Non-ferrous metals (copper, aluminum, brass, nickel silver)
- Nickel-phosphorus (NiP) coatings on various body materials
- Plastics and crystals

Our equipment

- LT Ultra MTC410 ultra-precision lathe with fast tool servo, slow tool servo and a separate B-axis for single point turning
- LT Ultra MMC1100-2Z machining center for diamond milling and fly-cutting
- Moore Nanotechnology 450 freeform generator with fast tool and optional Y-axis
- Precitech Nanoform 350 ultra-precision lathe
- UHM ultra-precision machining center for turning, planing and fly-cutting (proprietary development)
- Piezo fast tool servo for microstructuring and air-bearing fast tool servo for freeform machining (proprietary development)
Fraunhofer Institute for Production Technology IPT
Steinbachstraße 17
52074 Aachen
Germany
Phone +49 241 8904-0
Fax +49 241 8904-198
info@ipt.fraunhofer.de
www.ipt.fraunhofer.de

Contact

Dr.-Ing. Christian Wenzel
Phone +49 241 8904-220
Fax +49 241 8904-6220
christian.wenzel@ipt.fraunhofer.de

Dipl.-Ing. Roland Tücks
Phone +49 241 8904-152
Fax +49 241 8904-6152
roland.tuecks@ipt.fraunhofer.de