Fabrication of nano-structured mirrors from single crystal diamond

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Work content

High-power continuous-wave lasers are used in a diverse range of applications, from industrial fabrication to both applied and fundamental physics. In many of these, optical components, particularly mirrors, are required that can withstand the intense power generated while accurately directing the beam to its intended target. However, conventionally used mirrors that rely on thin-film coatings often contain imperfections that can absorb energy, leading to significant thermal stresses and potential melting of the constituent materials – irreversibly degrading the optical properties of the mirrors fabricated.

In this thesis, **nano-structured** mirrors will be fabricated from high-purity single crystal **diamond** to address these challenges, leveraging diamond's unique material properties (high refractive index, wide-bandgap, high mechanical hardness, and thermal conductivity). This will be achieved using equipment in the IMPT **cleanroom**, employing a state-of-the-art electron beam lithography tool and a reactive ion beam etcher to write and etch tapered, nano-scale features onto diamond substrates. This work will be conducted within the newly established **Diamond Research Group** at the IMPT, utilising its expertise and resources. The resulting reflectivity and power handling ability of the fabricated mirrors will then be thoroughly characterized in collaboration with experts at TU Braunschweig.

Type of work

Master's Thesis

Requirements

- Ability to work independently, in a structured and goal-oriented manner
- Interest in micro/nano fabrication, diamond research, and hands-on practical work
- Strong communication skills in English

Starting date

September 2025

07.04.2025

Field of work: Diamond Research Group

Leibniz Universität Hannover

Produktionstechnisches Zentrum Hannover