

UNIVERSITY OF TWENTE.

VACANCY PhD student on selective laser etching for integrated photonic applications



HOURS

38 - 40 hr.



SALARY INDICATION ⓘ

€ 2,770



DEADLINE

22 Sep 2023

Explore your PhD potential in cutting-edge research: join us in redefining Selective Laser Etching (SLE) of sapphire.

We are looking for a PhD-student to strengthen our highly motivated and multidisciplinary research team, who will work on Selective Laser Etching (SLE) of sapphire, in the framework of a large Dutch project, titled "Groefonds PhotonDelta". This latter project is targeting groundbreaking developments in Integrated Photonics.

THE BACKGROUND

Synthetic sapphire (aluminium oxide) is a hard, transparent and mostly inert material. Because of its unique physical and chemical properties it is employed in many fields of technology, including but not limited to Photonic Integrated Circuits (PIC). Because of its properties sapphire it is hard to create geometrical structures on or in sapphire. Applying ultra-short laser pulses the material can be locally transformed from crystalline to amorphous, at the (sub)micrometer scale. While sapphire, a crystalline form of aluminium oxide, is chemically inert to most substances, amorphous aluminium oxide is quite reactive and can be selectively etched. This two-step process is known as Selective Laser Etching.

For examples of recent work done in this line of research, please check:

- Capuano, L. et al. (2022). Fabrication of microstructures in the bulk and on the surface of sapphire by anisotropic selective wet etching of laser-affected volumes. *Journal of micromechanics and microengineering*, 32(12), [125003].
- Capuano, L. et al. (2020). Fabrication of millimeter-long structures in sapphire using femtosecond infrared laser pulses and selective etching. *Optics and Lasers in Engineering*, 133, [106114].

YOUR CHALLENGE

Selective Laser Etching of sapphire suffers from micro-crack formation around the laser affected volume and limited machining accuracy, impeding widespread application of the processing technique in a wide range of applications, which both need to be addressed at a scientific level. You will, as a PhD candidate, establish fundamental insight into the laser-matter interaction of short pulsed laser sources with aluminum oxide, in



edu.nl/mu7r3

order to establish the root cause(s) of laser-induced crack formation in the bulk of the substrate, through theoretical modeling as well as experiments. For the latter a state-of-the-art laser facilities are available in the Chair of Laser Processing. Based on the generated knowledge the PhD candidate will develop optimized strategies for laser processing of sapphire at the (sub)micrometer scale; and optimized recipes of subsequent chemical etching. Also, as an application of the technique, the PhD candidate will contribute to the development of a PIC sensor based on silicon-nitride-on-sapphire and will investigate its potential for mid-infrared applications, nonlinear photonics, optomechanical and MEMS applications.

You will closely collaborate with researchers in other groups at the University of Twente, namely the Mesoscale Chemical Systems group (wet chemical etching) and other groups involved in the Groefonds PhotonDelta project. You also will have access to the renown facilities of the NanoLab of MESA+ at the University of Twente.

If you're someone with a strong background in laser-material processing, preferably in ultra-short pulsed laser-material processing, driven by curiosity, creativity, and dedication, we invite you to apply for this opportunity.

UNIVERSITY OF TWENTE.

VACANCY PhD student on selective laser etching for integrated photonic applications

YOUR PROFILE

- You have a Master's degree, preferably with distinction (or international equivalent) in Mechanical Engineering, Applied Physics, Photonics, Materials Engineering, or a closely related discipline;
- Good knowledge/demonstrated awareness of fundamental aspects of laser-material processing. Applied knowledge in laser micromachining are an advantage.
- Knowledge in wet chemical etching is an advantage.
- Experience in using a range of technologies and techniques for surface characterisation, e.g. SEM, EDX, AFM, etc., would be an advantage.
- Ability to work in a laboratory environment and undertake experimental research.
- Good knowledge/demonstrated awareness of (numerical) modelling.
- Excellent analysis skills and an analytical mindset, as well as excellent communication skills, including written.
- English language proficiency. If you have not graduated in a country where English is the first language, then you will need to demonstrate your English proficiency by having passed IELTS or TOEFL. The minimum overall score for IELTS is at least 6.5 with no component being below 5.5.
- We encourage a high degree of responsibility and independence, while collaborating with close colleagues, researchers and other staff.
- Starting date of the position: as soon as possible.
- Applications from suitably qualified female applicants are particularly welcome.

OUR OFFER

- We offer a four-year fulltime PhD position.
- We provide a stimulating, modern research environment with world-class research facilities. And we provide excellent mentorship and a stimulating research environment to accelerate your further professional and personal growth.
- A starting salary of € 2770,= gross per month in the first year and increasing to € 3539,- gross per month in the fourth year.
- An annual holiday allowance of 8% of the gross annual salary, and an annual year-end bonus of 8.3%.
- A solid pension scheme.
- Minimum of 40 leave days in case of full-time employment.
- The University of Twente is situated on a green and lively campus with lots of facilities for sports and other activities.
- You will have a training programme as part of the Twente Graduate School where you and your supervisors will determine a plan for a suitable education and supervision;

THE CHAIR OF LASER PROCESSING

At the Chair of Laser Processing we study the fundamental physical phenomena occurring during laser-material interaction, in order to optimize laser-material processing for laser-based manufacturing. Based on the knowledge gained, we develop means and methods for monitoring/sensing and control of laser-material processing. Our research results (projects and publications) provide key enabling technologies for numerous new applications and innovative laser-based manufacturing. We are a group consisting of curiosity driven senior and junior scientists, which are well embedded within the department of Mechanics of Solids, Surfaces & Systems (MS3). Additional information can be obtained from the website

<https://www.utwente.nl/en/et/ms3/research-chairs/lp/>

UNIVERSITY OF TWENTE.

VACANCY PhD student on selective laser etching for integrated photonic applications

INFORMATION AND APPLICATION

Additional information about this position can be obtained from prof.dr.ir. G.R.B.E. Römer, department of Mechanics of Solids, Surfaces & Systems (MS³), Chair of Laser Processing, University of Twente, see <https://edu.nl/u3ux9> for contact details.

Submit your application no later than **September 22st**, 2023, through the link: <https://edu.nl/mu7r3>

Please upload your application, including:

- A full Curriculum Vitae, including a list of all courses attended and grades obtained, references and, if applicable, a list of publications, as well as a summary (half page) of your last large deliverable (such as MSc thesis, final project report, etc.),
 - References (contact information) of two scientific staff members (such as the supervisor of your MSc thesis/final project) who are willing to provide feedback on our request. Further references (e.g. industrial supervisor or other mentors) can be additionally provided.
 - A Motivational letter (max. 1 A4), emphasizing your specific interest, qualifications, motivations to apply for this position and research ideas for the PhD project.
- As an appendix to the motivation letter, add (max. 1 A4) with your answers to the following questions (even though, in your CV, you might have already addressed those questions):
 - Do you have hands on experience with experimental optical and/or laser setups? If so, what kind of setup(s)?
 - Have you worked with photonic or electronic materials?
 - Have you worked with wet chemical etchants?
 - Did you ever use material analysis and microscopy techniques? If so, which techniques?
 - Have you published any work in peer-reviewed publications? If so, in which publications (journal, conference, other) and how many?
 - Have you worked or studied in a country different to where you obtained your primary academic education? If so, where?
 - Do you have experience in numerical modelling of physical processes? If so, what process(es) and what software tools?
 - What is your IELTS/Cambridge English level?
 - A video (max. 2 minutes) describing your scientific interests and why you are applying for this position.

A Game-Based assessment can be part of the selection procedure.