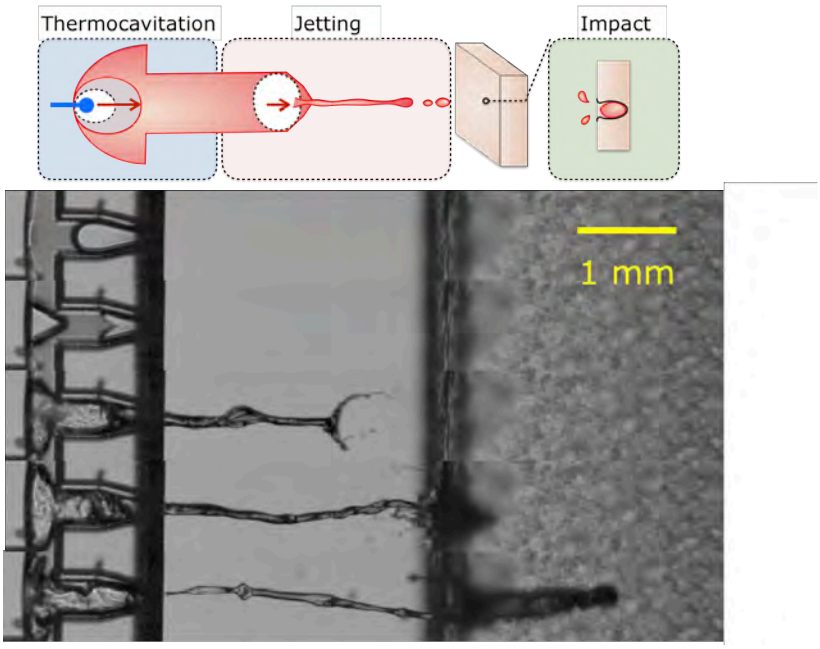
OPEN POSITIONS within the MESOSCALE CHEMICAL SYSTEMS GROUP (3 PhDs + 1 postdoc)

As part of the **ERC Starting grant project BuBble Gun**, we are looking to fill **three** PhD positions (4 years), and **one** post-doc position (2 years).

The **needle-free delivery of liquid jets** into soft and heterogeneous substrates, e.g. human tissue, has been hindered by the need to reach specific penetration depths with energy efficient means, by the break-up of jets that impedes control over the dose delivery, and by liquid splash-back after impacting the substrate that causes cross-contamination between injections. BuBble Gun aims at overcoming these challenges.

BuBble gun will advance scientific knowledge at the intersection of microfluidics, physics, and bioengineering, to enable unprecedented physical understanding and control over cavitation, jetting, and injection phenomena. We will develop a portable energy-efficient injection platform by using ultra-high-speed imaging, and quantifying injections with experimental resolutions below the microsecond and micrometer scales. The rheological properties of the jets will be tuned with biocompatible additives to ensure cohesion, before injecting them into in-vitro targets and ex-vivo skin. Numerical models will assist in untangling the influence of microfluidic configuration and material properties on the injection outcome.



Applications should include the following documents:

- A motivation letter describing why you apply for this position, with a description of your research interests (no more than 1 A4).
- A detailed CV.
- Academic transcripts from your **Bachelor's** and **Master's** degrees.
- Email addresses of at least two references who are willing to send a letter of recommendation on your behalf.

An interview with a scientific presentation will be part of the interview process.

Environment:
The University of Twente (UT) stands for life sciences and technology, with the motto "High tech and human touch", developing new technologies that drive change, innovation and progress in society. The UT is the only campus university in the Netherlands providing more than fifty educational programs, with a strong focus on personal development where talented researchers are given scope for carrying out pioneering research and explore the valorization of their ideas.

Within the **TNW Faculty** (Faculty of Science & Technology) of the University of Twente some 700 staff members and 2000 students are involved in training and research on the interface of chemical technology, applied physics and biomedical technology. Fields of application include sustainable energy, process technology and materials science, nanotechnology and technical medicine. Research, which enjoys a high profile both at home and internationally, has been accommodated in the multidisciplinary research institutes MESA+ and the TechMed Centre. The faculty works together intensively with industrial partners and researchers in the Netherlands and abroad and conducts extensive research for external commissioning parties and funders. https://www.utwente.nl/en/

The research group:
The Mesoscale Chemical Systems is part of the MESA+ Institute for Nanotechnology, and of the Technical Medical (TechMed) Centre. The group has unique expertise in micro and nanofabrication, backed by the outstanding experimental facilities of MESA+ NanoLab. The research and valorization activities of the group encompass microfluidics, ultrasound technologies, electrochemistry and bioengineering. MCS offers a rich, multidisciplinary and very international (over a 12 nationalities) environment where experimental physics, advanced chemical processes and simulation work are applied to solve relevant societal problems, as well as curiosity-driven research. The group is in embedded within an international network and promotes international collaboration and exchanges. In particular, this project will be in collaboration with the Department of Mechanical Engineering at the Massachusetts Institute of Technology MIT, and the School of Medicine in Harvard, USA.

PhD1 - Cavitation: study of light-generated ultrafast bubble dynamics in microfluidic devices
In this project, new knowledge will be sought on energy conversion from light-source into bubble expansion and collapse inside microfluidic channels. Different geometrical designs will be employed to understand and control meniscus dynamics with the corresponding characterization of physicochemical fluids properties. Fluidic and thermal models will be developed simultaneously with the mainly experimental work.

PhD2 - Jetting: rheologic investigations to achieve reproducible jetting with minimal jet break-up.
This project will be focused on characterization of liquid jets (diameter, length, volume, velocity, satellite droplets size distribution, etc.). The rheology of the jets made with a microfluidic device where cavitation takes place will be tuned to obtain predictable jets with velocities ~100 m/s and diameters ≤50 µm. This will be achieved with additives and geometrical control of contact line and meniscus to focus energy. These jets should be able to penetrate the human skin.

PhD3 - Impact: investigation of liquid jet injection into soft substrates with minimal splash-back.
The main objective of this project is to gain understanding on jet penetration and dispersion into skin surrogates and ex-vivo skin. We will devise the time-dependent dispersion of several liquids and its retrospective analysis, injected with microfluidic devices that generate reproducible jets, assisted by numerical simulations. The gained knowledge will be crucial to inject fluids without needles for drug delivery and other applications.

PhD profile:

- You have a background in applied physics, mechanical or biomechanical engineering, or in a closely related discipline.
- You have strong communication skills, including fluency in written and spoken English.
- You are able to work independently, and have excellent theoretical and experimental skills.
- Since the work will be mostly experimental, experience in the laboratory in any level is appreciated; but experience in microscopy, microfluidics, rheology, spectrometry, photonics and/or detection techniques will be considered as an advantage.
- Team-working skills are expected from the candidate due to the multidisciplinary and collaborative approach of the project.

Postdoc – Needle-free injection platform design and construction
The main activities will be on the design and construction of the experimental setup that will be used by the three PhD students working on this project. This setup will shed light on the physicochemical mechanisms related to thermocavitation-driven jet injections with a platform for other scientific uses. As an experienced researcher, you will assist the PhD candidates and actively participate in the dissemination of the scientific results of the team.

Postdoc profile:

- You hold a PhD degree in a related topic: physics, (bio)mechanical engineering, microfabrication
- Ample experience in experimental techniques of fluid dynamics and preferentially in ultra-fast imaging
- Able to function effectively within a multidisciplinary team, and handle a high degree of professional autonomy
- You are expected to perform research of high quality, help in coordinating between partners (researchers and industry) contributing to the success of the project
- Excellent language skills in English
- Entrepreneurial, innovative and result-focused

Our offer:
As a PhD candidate you will be offered a full-time (38 hours/week) position for four years, after which you should have completed your PhD thesis. In accordance with the Collective Labour Agreement for Dutch Universities, the gross monthly salary for a PhD increases from € 2325,-- in the first year to € 2972,-- in the final year plus a holiday allowance (8%), an end-year bonus (8.3% of the annual salary) and a number of additional benefits. The University of Twente provides excellent campus facilities, and actively supports professional and personal development.

As a Postdoc you will be offered a full-time (38 hours/week) position for 18 months. Salary and conditions will be in accordance with the Collective Labour Agreement (CAO) of the Dutch Universities. Gross monthly salary depends on experience and qualifications and ranges from € 3255,- to € 4274,-. Additionally, the University of Twente provides excellent facilities for professional and personal development, a holiday allowance (amounts to 8%), an end-of-year bonus (amounts to 8,3%) and a number of additional benefits.

- We provide excellent mentorship and a stimulating, modern research environment with world-class research facilities.
- You will be embedded in a dynamic research group.
- Additionally, the UT is a green campus with excellent facilities and resources for professional and personal development.
- You will follow a high-quality personalized educational program.
- The research will result in a PhD thesis at the end of the employment period.

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