



Efficient fabrication of single-particle-thick micropaths, their characterization and applicability

Project OPUS 17

Position 1: **Post-doc**

Duration: **24 months**

Starting date: **preferably July 2020**

Salary: **PLN 10000 gross/month (~6000 net/month)**

Institution: **Faculty of Physics, Adam Mickiewicz University in Poznań**

Principal Investigator: **dr hab. Zbigniew Rozynek**

Email address for applications: zbiroz@amu.edu.pl

Application deadline: **21 June 2020**

Requirements

- The successful applicant should hold a PhD title (at the date of employment) in an experimental physics or related material sciences. The degree has to be obtained within 7 years prior to joining the project.
- A candidate with the knowledge of soft matter physics, direct-assembly phenomena, and electronics will be preferred.
- Because a part of the work will be devoted to outreach and popularization of the research and the lab activities, strong communication skills will therefore be required.
- Required language: English, level: advanced
- Hard skills such as machinist, programmer skills, and ability to design simple electronic circuits are welcomed.
- Part of the experimental work will be performed in collaboration with partners from Norway and USA. Therefore, the candidate will have to be able to travel abroad where they will work for three months or longer.

Application

- Application, including CV, scan of PhD diploma and motivation letter, should be sent as a single pdf-file to zbiroz@amu.edu.pl.
- Please include in your application the following phrase: "In accordance with the Personal Data Protection Act from 29 August 1997, I hereby agree to process and to store my personal data by the Adam Mickiewicz University in Poznań for recruitment purposes". By submitting the application, you consent to the processing of your personal data in the recruitment process. The controller of your personal data is Adam Mickiewicz University in Poznań.
- Publications and any other work, which the applicant wishes to be taken into account, must be enclosed together with the above-mentioned documents. Joint works will be considered provided that a short summary outlining the applicant's contributions is attached.
- E-mail addresses of two senior scientists (that may be asked for recommendations) should be provided together with the application.

Additional information

- Selected candidates will be invited for the interview - the date will be communicated to the candidates individually. The interviews will most likely take place in the last week of June 2020. The competition results will be announced by the end of June 2020.
- The position adheres to the policy of balanced ethnicity, age and gender.
- Information concerning the applicant may be made public.
- For further information about the position, please email dr hab. Zbigniew Rozynek, zbiroz@amu.edu.pl



Position 2: **Post-doc**

Duration: **24 months**

Starting date: **preferably July 2020**

Salary: **PLN 10000 gross/month (~6000 net/month)**

Institution: **Faculty of Physics, Adam Mickiewicz University in Poznań**

Principal Investigator: **dr hab. Zbigniew Rozynek**

E-mail address for applications: zbiroz@amu.edu.pl

Application deadline: **21 June 2020**

Requirements

- The successful applicant should hold a PhD title (at the date of employment) in chemistry, physics or related material sciences. The degree has to be obtained within 7 years prior to joining the project.
- I will seek for a candidate with complementary skills to those of the Post-doc 1, for example, knowledge of chemical modification of particles and substrates.
- Because a part of the work will be devoted to outreach and popularization of the research and the lab activities, strong communication skills will therefore be required.
- Required language: English, level: advanced
- It is expected that the candidate will actively pursue possibilities for new projects within the field, by participating/submitting applications to the EU, the National Center for Research and Development, and industry to enable smooth continuation of the research after the tasks in the proposed research project are completed. Thus, knowledge about the proposal calls and good writing skills will be appreciated.
- Part of the experimental work will be performed in collaboration with partners from Norway and USA. Therefore, the candidate will have to be able to travel abroad where they will work for three months or longer.

Application

- Application, including CV, scan of PhD diploma and motivation letter, should be sent as a single pdf-file to zbiroz@amu.edu.pl.
- Please include in your application the following phrase: "In accordance with the Personal Data Protection Act from 29 August 1997, I hereby agree to process and to store my personal data by the Adam Mickiewicz University in Poznań for recruitment purposes". By submitting the application, you consent to the processing of your personal data in the recruitment process. The controller of your personal data is Adam Mickiewicz University in Poznań.
- Publications and any other work, which the applicant wishes to be taken into account, must be enclosed together with the above-mentioned documents. Joint works will be considered provided that a short summary outlining the applicant's contributions is attached.
- E-mail addresses of two senior scientists (that may be asked for recommendations) should be provided together with the application.

Additional information

- Selected candidates will be invited for the interview - the date will be communicated to the candidates individually. The interviews will most likely take place in the last week of June 2020. The competition results will be announced by the end of June 2020.
- The position adheres to the policy of balanced ethnicity, age and gender.
- Information concerning the applicant may be made public.
- For further information about the position, please email dr hab. Zbigniew Rozynek, zbiroz@amu.edu.pl



Position 3: **PhD position**

Duration: **36 months**

Starting date: **Sept/Oct 2020**

Stipendship: **PLN 5000 net/month**

Institution: **Faculty of Physics, Adam Mickiewicz University in Poznań**

Principal Investigator: **dr hab. Zbigniew Rozynek**

Email address for applications: zbiroz@amu.edu.pl

Application deadline: **30 July 2020**

Requirements

- The successful applicant should hold a Master's degree in Physics or research relevant disciplines. An average grade 4 (B) or better (as measured in ECTS grades).
- The applicant must provide evidence of good English language skills, written and spoken.
- A candidate with the knowledge of soft matter physics, direct-assembly phenomena, and electronics will be preferred.
- Because a part of the work will be devoted to outreach and popularization of the research and the lab activities, strong communication skills will therefore be required.
- Hard skills such as machinist and programmer skills, ability to design simple electronic circuits are welcomed.
- Part of the experimental work will be performed in collaboration with partners from Norway and USA. Therefore, the candidate will have to be able to travel abroad where they will work for three months or longer.

Application

- Application, including CV, scan of MSc diploma and motivation letter, should be sent as a single pdf-file to zbiroz@amu.edu.pl.
- Please include in your application the following phrase: "In accordance with the Personal Data Protection Act from 29 August 1997, I hereby agree to process and to store my personal data by the Adam Mickiewicz University in Poznań for recruitment purposes". By submitting the application, you consent to the processing of your personal data in the recruitment process. The controller of your personal data is Adam Mickiewicz University in Poznań.
- Publications and any other work, which the applicant wishes to be taken into account, must be enclosed together with the above-mentioned documents. Joint works will be considered provided that a short summary outlining the applicant's contributions is attached.
- E-mail addresses of two senior scientists (that may be asked for recommendations) should be provided together with the application.

Additional information

- Selected candidates will be invited for the interview - the date will be communicated to the candidates individually. The interviews will most likely take place in August 2020. The competition results will be announced by the end of August 2020.
- The position adheres to the policy of balanced ethnicity, age and gender.
- Information concerning the applicant may be made public.
- For further information about the position, please email dr hab. Zbigniew Rozynek, zbiroz@amu.edu.pl
- The recruitment for this position (and both post-doc positions) will be competition-based, and will be carried out accordingly to the guidelines provided by the NCN (https://www.ncn.gov.pl/sites/default/files/pliki/uchwaly-rady/2019/uchwala25_2019-zal1.pdf), and in accordance with the highest standards.

General information on the project

The objectives of this research project are: (i) to develop methods for efficient fabrication of single-particle-thick structures and their deposition on substrates in a form of micropaths, (ii) to understand the mechanical and electrical properties of the assembled chain-like structures, (iii) to investigate viability of the produced particle micropaths with respect to their usage in various applications, including in flexible electronics.

The useful properties of the single-particle-resolution structures, such as high surface-to-volume ratio, long-range ordering, or periodicity at mesoscale, can be harnessed in a variety of devices, including optical, biosensing, photovoltaic, and electronic devices. There are several strategies and techniques for assembling particles in chain-like structures on substrates. Yet, each of the methods has one or (commonly) more of the following disadvantages: it is expensive, time-consuming, inefficient, unsuitable for formation of non-linear structures, unable to position the particle microstructures in a designed fashion, or suitable for formation of structures only in bulk liquids; requires access to advanced tools and laboratories; or enables assembly of particle structures with limited lengths. Thus, the assembly of single-particle-resolution micropaths with controlled length and well-behaved configuration in a simple and effective way is still a great challenge. This hugely hinders the possible applicability of such structures and development of new materials and devices. The proposed research is a response to this problem. An electric field-assisted route for side by side particle deposition on substrates is proposed here. The method overcomes all of the abovementioned limitations and enables high-throughput organization of particles on a variety of different substrates at low cost.

There are dozens of scientific questions to be answered and technical challenges to be tackled, as the studied system is very rich in physical phenomena. Various aspects of the proposed route, including the role of particle size and shape, properties of both the dispersion liquid and substrate, as well as parameters of the electric field will need to be studied in detail. There are also several important characteristics of the 1D particle structures to research, including their mechanical and electronic properties. Because the proposed method for assembling particle micropaths on various substrates is particularly promising for producing conductive pathways, we will also study the system from the perspective of its future applications in electronics. The proposed project comprises seven research tasks grouped into three main thematic blocks, as presented in the table below.

Thematic Block 1	
1.1. Understanding of physical mechanisms behind the method of fabricating particle micropaths	
1.2. Optimizing the methods, increasing their efficiency, scaling up the micropath production	
1.3. Further development of the method to achieve deposition of more complex particle patterns	
Thematic Block 2	Thematic Block 3
2.1. Characterization of the deposited particles (durability, mechanical & electronic properties)	3.1. Demonstration of feasibility of the method and the use of microstructures for electronics applications
2.2. Postprocessing of the deposited micropaths	3.2. Other applications (composites and porous materials)

Literature

1. Rozynek Z, Han M, Dutka F, Garstecki P, Jozefczak A, Lijten E. Formation of printable granular and colloidal chains through capillary effects and dielectrophoresis. *Nat Commun* **8**, 15255 (2017).
2. Dutka F, Rozynek Z, Napiorkowski M. Continuous and discontinuous transitions between two types of capillary bridges on a beaded chain pulled out from a liquid. *Soft Matter* **13**, 4698-4708 (2017).