

## Fully funded Doctoral/MSc researcher (m/f/d) at the interface between digital fabrication, environmental design, and material science

5.1.2023

As part of the research project ***Developing Construction Products and Processes from Recycled Waste Materials***, we are recruiting several Doctoral / Master's researcher positions. The project will harness the environmental potential of *recycled wood/polymer materials (RWPM)* by developing building products and fabrication processes using **additive manufacturing** and **pressurised casting**.

The project is fully funded by the Israel Innovation Authority (IIA) and will be carried out by a team of Doctoral and Master students. A generous monthly stipend will be paid to the researchers according to their qualifications and experience.

### **Background:**

The construction industry is responsible for over 38% of the world's annual emissions of carbon dioxide. Over 60% of this can be directly attributed to the production of traditional building materials such as concrete and steel. Industrial waste materials such as wood and plastic can be converted into a family of sustainable materials, which we will refer to as Recycled Wood and Polymer based Materials (RWPM). The properties of these materials vary with the relative quantities of wood and polymers, but they all have significantly improved environmental impact over traditional building materials. However, despite their similar performance and obvious advantages, RWPM materials have not been widely adopted by the construction industry.

This research builds upon recent innovations in material science and fabrication technology to develop ways to incorporate RWPM into the construction industry. We will adapt additive manufacturing and pressurised casting technologies for use with bio-based materials to create modular building elements and print building sections using large nozzles. These technologies will be used to develop RWPM building elements such as blocks, structural elements and entire printed wall sections which will be used to replace traditional building elements. The first result of this research will be a set of built prototypes from at least 50% recycled materials for the construction industry. The second result will be the fabrication processes used to manufacture these elements. The developed processes will be able to turn the recycled materials into elements with similar structural performance of traditional building elements with significantly improved thermal performance and reduced environmental impact.

### Your Tasks (PhD):

- Carry out research to the highest scientific standards, including both theoretical and experimental work.
- Active participation in the scientific community with peer reviewed research papers in major journals and presentations at international conferences.
- Define and develop a research methodology
- Design building elements made from RWPM.
- Develop fabrication processes for RWPM.
- Supervise a design and prototyping team of graduate and undergraduate students.
- Engage with stakeholders in industry to understand challenges in practice and identify needs for applied research and innovation pathways.
- Support ongoing development and operation of the lab
- Support grant applications in related fields.
- Showcase outcomes of your PhD project in an exhibition.

### Your Tasks (MSc):

- Define and develop a research methodology for exploring a certain, well-defined aspect of the RWPM project.
- Design building elements and develop fabrication processes for one of the fabrication techniques.
- Work in a team of PhD, graduate and undergraduate students.
- Support grant applications in related fields.
- Active participation in the science community with a peer reviewed presentation at an international conference.
- Showcase outcomes of your MSc project in an exhibition.

### What we expect (PhD):

- M.Sc. / M.Arch degree in one of the following areas (or a related area), earned no more than three years prior to the start of the PhD: Architecture, Industrial Design, Computational Design, Robotics, Material Science.
- Solid technical understanding in several of the following fields:
  - Bio-based building materials
  - Circularity in construction materials
  - Building Performance for Facades & Panelling systems
  - Additive Manufacturing / Digital Fabrication
  - Making, Prototyping and Testing
- Excellent 3D modelling skills.
- Extensive fabrication experience (Robotic manufacturing, Additive manufacturing or CNC)
- Programming experience, e.g., Rhino3D + Grasshopper + (C# or Python).
- A track record of research and publication.

- Ability and experience in academic writing and oral communication.
- Fully fluent in writing, reading and speaking English.

Additional skills that we are looking for include:

- Genuine enthusiasm for research in the field of environmental fabrication.
- Proven ability and experience leading and working with teams.
- Demonstrated research experience in interdisciplinary settings

#### **What we expect (MSc.):**

- B.Sc. / B.Arch. / B.Des. degree in one of the following areas (or a related area), earned no more than three years prior to the start of the MSc.: Architecture, Industrial Design, Computational Design, Robotics, Material Science.
- Excellent 3D modelling skills.
- Fabrication experience (Robotic manufacturing, Additive manufacturing, or CNC)
- Associative programming experience, e.g., Rhino3D + Grasshopper
- Ability and experience in academic writing and oral communication.
- Fully fluent in writing, reading and speaking English.

Additional skills that we are looking for include:

- A Genuine enthusiasm for research & design in the field of environmental fabrication.
- Ability to work within a research team.

#### **Our offer:**

We offer an interesting and challenging opportunity in a motivated international research team. All positions in this project will be generously funded by both the Technion and the Israel Innovation Authority, allowing you to focus on your academic work. The research will be based in the Technion in Haifa, Israel and the position requires physical attendance during the majority of the research period. The Technion – Israel Institute of Technology ranks among the world's top universities, as measured by several key independent rankings. The Technion offers significant support to international research students through a broad range of scholarships and research travel awards, dedicated office spaces, skills training, and professional development opportunities. The campus is located in the coastal city of Haifa on the Carmel Mountain, offering a unique nature experience and quality of life.

The D.DLab <https://ddlab.net.technion.ac.il/> and the CD\_ML lab <https://cdml.net.technion.ac.il/> are design-led technological research groups of graduate, PhDs, and postdoc members. The labs have advanced laboratory facilities for computer aided design and manufacturing projects at the Technion-Architecture and Town Planning Faculty. The researcher will be sponsored jointly by both labs or choose one of them according to their chosen field of research.

### Contact and application:

Severely disabled persons will be given preference in the case of essentially equal suitability and qualifications. The Technion aims to increase the proportion of women in science; applications from women are therefore expressly welcomed.

Please send your application with a short letter of motivation, CV, certificates, as well as the contact details of two references to Prof. Shany Barath ([barathshany@technion.ac.il](mailto:barathshany@technion.ac.il)) and to Dr. Guy Austern ([guyaustern@technion.ac.il](mailto:guyaustern@technion.ac.il)) **by 10 February 2023**. Please send all documents as a single PDF document.