

## **Assembly of particle chains based on dielectrophoretic, magnetic and capillary effects**

Soon, the smartphones in our pockets will be equipped with an elastic display, and the t-shirts we are wearing will measure parameters of our bodies to report any sign of illness. Yet, before this happens, new types of materials and efficient methods for their fabrication have to be developed. A very promising method that might be a breakthrough for large-scale manufacturing of flexible electronic devices was demonstrated two years ago by experimental scientists. They showed that by applying AC electric current, centimetre-long and micrometre-thick chains of particles can be assembled and deposited on substrates to form paths that conduct electric charges. Unlike today's standard manufacturing technologies for electronic components, their method makes it possible to deposit the paths on surfaces that are convex or concave or have irregular geometry, and they can be bent, stretched or compressed. However, until now, this technique has not been commercially available, as many aspects of this process remain unexplained. This is mainly due to the lack of a theoretical model to understand the physics behind the formation of the chains and their consecutive deposition on a substrate.

This project aims to fill in this method's theoretical gap. We plan to build a computer model that will predict how the forces acting on particles within a chain change when its geometry changes. Only then will we be able to answer questions like what (and how) parameters should be adjusted to obtain paths with the highest ordering of particles and/or the highest electric conductivity. This in turn will allow us to optimize the method to assemble high-quality paths at high production speeds.

Furthermore, we plan to extend the original method such that magnetic micropaths can also be assembled. To this end, we will install an electromagnet in the place of the electrode. In the magnetic field it will generate, all the particles will start to behave like small magnets and attract each other with opposite poles to form an elongated chain that can be subsequently deposited on an arbitrary substrate. In this way, the deposited particles will be aligned with superior precision, which is vital in many applications.