

A combined electrospinning and microextrusion apparatus



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Invention

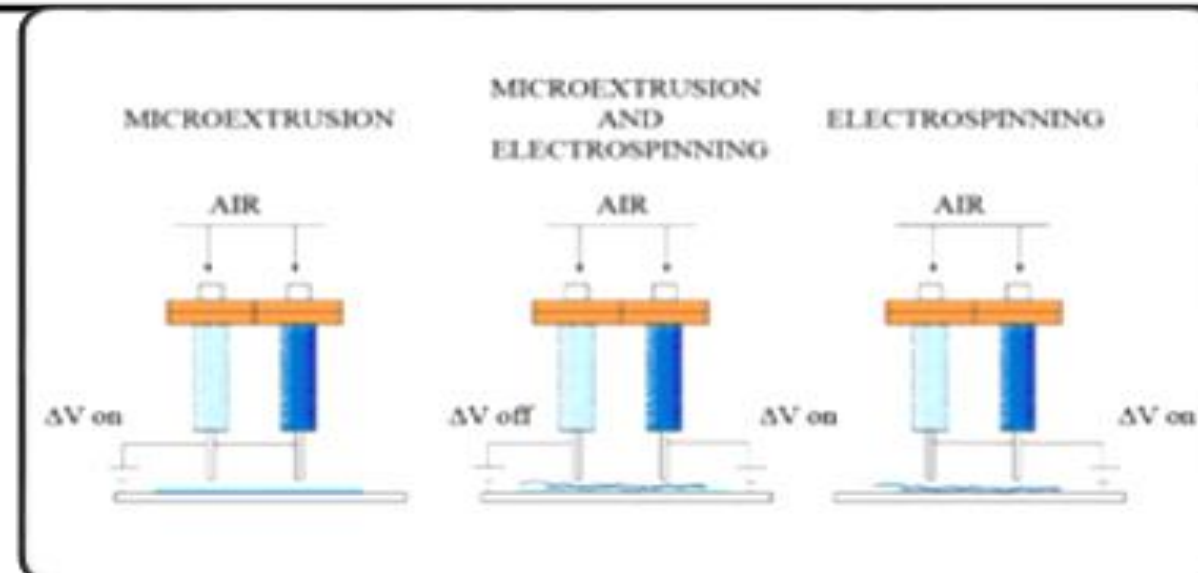
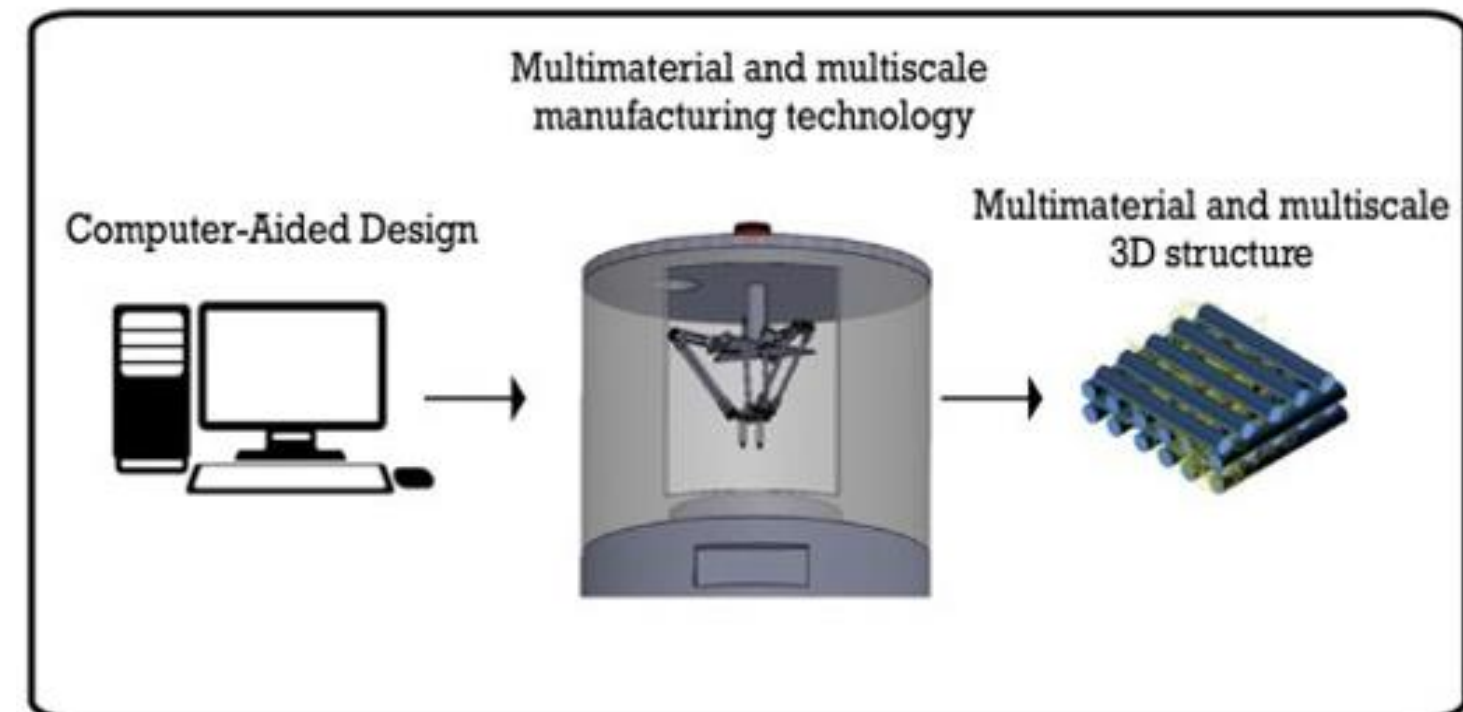
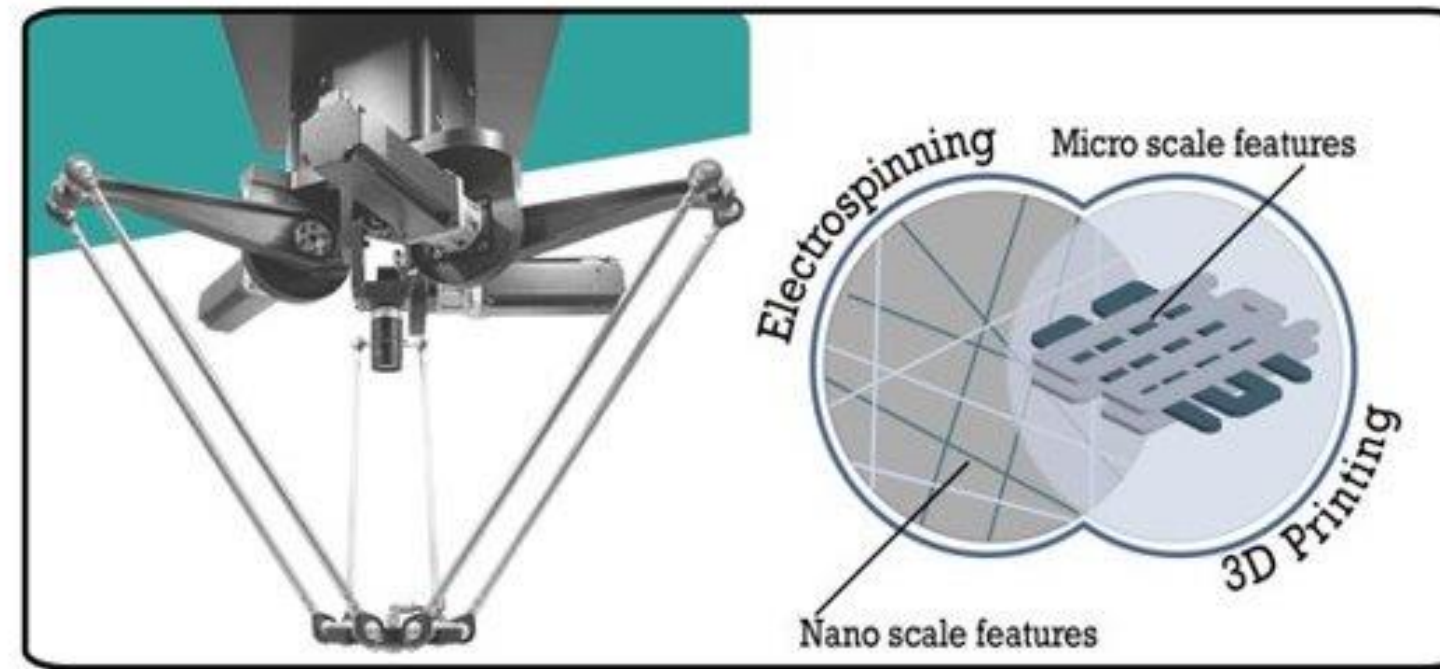


The patented invention covers **nano- and micro-fabrication techniques of 3D structures using CAD/CAM technology specially designed** to process two or more different materials with nanometric and/or millimeter resolution at the same time. This technology, named "**ELECTROSPIDER**", consists of a robotic manipulator, whose final effector is equipped with a plurality of pneumatic extruders with interchangeable nozzles to deposit multiple materials by microextrusion (to fabricate microscale elements) or electrospinning (to fabricate nanoscale elements) in an independent or combined 3D space.

Currently, multi-scale and multi-material 3D structures are produced using more than one manufacturing system, which requires the manual movement of the object from one machine to another until the completion of the structure. This approach requires the presence of a dedicated operator, allowing the manufacture of structures with a low level of accuracy and precision. The proposed invention has extruders able to **operate independently in micro-extrusion or electro-spinning modes**, solving the problem of having separate processing stations present in current devices, reducing space and increasing the speed of construction of the structure, without penalizing the resolution and accuracy.

This invention allows to process with **micrometric and/or nanometric resolution a plurality of materials**, both synthetic (e.g. polycaprolactone, polyethylene terephthalate, nylon) and natural (e.g. gelatin, pectin, chitosan) making the platform a tool with broad application perspectives.

Drawings
& pictures



Industrial applications



Advanced Manufacturing Technologies / Manufacturing 4.0: the technology offers the possibility to manufacture multi-scale and multi-material 3D structures with a combined approach of Additive Manufacturing (AM) and electrospinning.

Medtech / Biotechnology: the technology is able to process a wide range of biocompatible materials degradable/ non-degradable for the manufacture of 3D multi-scale and multi-material structures that can support cell adhesion and proliferation, to incorporate medicines, proteins or other agents desired for applications that include tissue engineering and the regeneration of new tissues for medical purposes or for the administration of localized drugs. The proposed technology can also be used in the field of biotechnology for manufacturing.

Nanotechnologies: the proposed technology represents a nanotechnological platform for the manufacture of nanofibrous structures useful in many biomedical applications such as tissue engineering or biosensing, in electronics, microfluidics and air or water filtration systems.



Advantages and benefits for a company

The proposed system, as it was designed, is able to offer the following advantages compared to the currently available approaches for multi-scale and multi-material manufacturing:

- lower purchase and maintenance costs;
- fully automatic and continuous manufacturing process;
- accurate, accurate and reproducible manufacturing process;
- reduction of manufacturing time;
- manufacture in a controlled environment (temperature and humidity control);
- compact design.

Possible developments



The present invention (TRL 4) allows to **manufacture structures with micrometric and/or nanometric resolution and with a plurality of materials**, both of synthetic origin (e.g. polycaprolactone, polyethylene terephthalate, nylon) and natural (e.g. gelatin, pectin, chitosan) providing the platform a tool with broad application perspectives.

The research team is working for the industrial development of technology and related patents with the aim of creating an innovative start-up to sell the manufacturing platform as an advanced multi-scale and multi-material manufacturing technology for industry or research laboratories, or to offer an outsourcing manufacturing service on target markets.

For this purpose, the team is currently working on the experimental development of the proposed technology and then testing it in the presence of a panel of potential customers in order to obtain useful feedback to refine the prototype and to develop a product tailored to markets identified.

POSSIBLE IMPLEMENTATIONS for:

- Manufacture of circuits for microfluidics;
- Manufacture of sensors/actuators;
- Manufacture of electronic circuit ;
- Manufacture of packaging products;
- Manufacture of air/water filtration membranes;
- Biotechnology;
- 3D Bioprinting - manufacture of scaffolds for Tissue Engineering.

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