3D printing for alginate aerogel obtainment

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For a number of applications, there is a requirement to obtain aerogels that have a defined structure both at the nanoscale and macroscale. Varying the parameters of the processes occurring at the stages: preparation of the precursor solution, gelation, preparation for supercritical drying, allows controlling the aerogels structure at the nanoscale. Additive technologies at the gelation stage allow varying the shape of products over a wide range (macroscale). 3D printing technologies reduce material consumption and production time unlike traditional methods of forming three-dimensional objects, which involve removing excess material. Extrusion was chosen as the used additive technology.

In the present work, an approach that allows to control the structure of materials at both the nanoscale and macroscale has been developed. In this approach, partially crosslinked alginate gels are used as ink for 3D printing. After the printing process, the resulting products hold the defined shape. Aging in the solution of a crosslinking agent is used for final crosslinking. Further, the products are washed from excess solution of a crosslinking agent and the solvent is replaced step by step with isopropanol, followed by supercritical drying. In addition, experiments were carried out with the ink with embedded multilayer carbon nanotubes to improve the strength and electrical conductivity.

The gel-printing technique assist to the rapid manufacture of prototypes for different applications (flexible electronics, tissue engineering).

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