**SYNTHESIS AND CHARACTERIZATION OF 3-D ALUMINA SCAFFOLDS FOR HUMAN NEURAL PRECURSOS CELLS TISSUE-LIKE APPLICATIONS**

**N. Anagostakis1, G. Kastrinaki2\*, C. Pagkoura2, E. M. Pechlivani3,** **N. Kladovasilakis3 ,S. Petrakis4,**

**I. Gkekas4, V. T. Zaspalis1, 2, A. Asimakopoulou2**

1 Department of Chemical Engineering, Aristotle Unoversity of Thessaloniki, 54006, Thessaloniki

2Chemical Process and Energy Resources Institute, CERTH, 57001, Thessaloniki

3 Information Technologies Institute, CERTH, 57001, Thessaloniki

4Institute of Applied Biosciences, CERTH, 57001 Thessaloniki

*\* georgiak@certh.gr*

**ABSTRACT**

The nervous system is characterized by high-complexity and three-dimensional (3D) interconnectivity of its cellular components, i.e., the neurons and non-neuronal glial cells. However,

in brain disorders (e.g. traumatic brain injury), tissue architecture is damaged and neuronal signals

which regulate the homeostasis and function of the body are not properly transmitted. The recent

advances in induced-pluripotent stem cell technology and the development of the appropriate diferentiation protocols allowed the in vitro generation of human neuronal cells which could be used for biotechnological or regenerative therapeutic approaches. These cells are predominantly grown in two-dimensional (2D) monolayer cultures which are easy to use and analyze. However, tissue-specific architecture and mechanical signals that regulate the maturation, communication, and physiological function of neurons are not properly modelled. In contrast, 3D cultures allow the organization of neuronal cells into tissue-like structures that better reproduce the in vivo microenvironment. Neural blocks or cell spheroids have been previously utilized for the construction of complex 3D structures. Although promising, these structures may not be functional in vitro or in vivo, due to insucient provision of nutrients in cells of their inner layers or limited integration and poor functionality into the host tissue.

In the current study 3D alumina structures have been synthesized either by: i) the foam replica technique, i.e. by coating alumina nanoparticles upon polyurethane sponges, which are used as sacrificial templates, followed by calcination protocols aiming at controllable removal of the organic phase and sufficient sintering of the alumina phase, or ii) coating of 3D printed SiO2 porous structures with a boehmite precursor solution. The aim of the present work is to examine whether the established biocompatibility of alumina-based 2D ceramic materials observed and described in previous work [1] also applies in the case of 3D foam-like bioceramics and further evaluate whether the proliferation of human neural precursor cells (NPCs) and their differentiation into functional neurons can be favored in three-dimensional structures.

**KEYWORDS:** alumina, scaffold, neural precursor cells

**REFERENCES**

[1] Asimakopoulou, Α., Gkekas, Ι., Kastrinaki, G., Prigione, Α., Zaspalis, V.T., & Petrakis, S. (2020), *J. Funct. Biomater.*, 11 (65).