Direct cell imprint lithography in superconductive carbon black polymer composites : process optimization, characterization and *in vitro* toxicity analysis

Vigneswaran Narayanamurthy[1,2], Fahmi Samsuri[1], Al'aina Yuhainis Firus Khan[3], Hairul Aini Hamzah[2], Madia Baizura Baharom[2], T V Kumary[4], P R Anil Kumar[4] and Deepa K Raj[4]

[1] Faculty of Electrical and Electronics Engineering, University Malaysia Pahang, Pekan 26600, Malaysia
[2] Faculty of Medicine, International Islamic University Malaysia, Kuantan, Pahang 25200, Malaysia
[3] Faculty of Allied Health Sciences, Department of Biomedical Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia
[4] Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Science and Technology, Trivandrum, Kerala 695012 India

ABSTRACT

Cell imprint lithography (CIL) or cell replication plays a vital role in fields like biomimetic smart culture substrates, bone tissue engineering, cell guiding, cell adhesion, tissue engineering, cell microenvironments, tissue microenvironments, cell research, drug delivery, diagnostics, therapeutics and many other applications. Herein we report a new formulation of superconductive carbon black photopolymer composite and its characterization towards a CIL process technique. In this article, we demonstrated an approach of using a carbon nanoparticle-polymer composite (CPC) for patterning cells. It is observed that a 0.3 wt % load of carbon nanoparticles (CNPs) in a carbon polymer mixture (CPM) was optimal for cell-imprint replica fabrication. The electrical resistance of the 3-CPC (0.3 wt %) was reduced by 68% when compared to N-CPC (0 wt %). This method successfully replicated the single cell with sub-organelle scale. The shape of microvesicles, grooves, pores, blebs or microvilli on the cellular surface was patterned clearly. This technique delivers a free-standing cell feature substrate. *In vitro* evaluation of the polymer demonstrated it as an ideal candidate for biomimetic biomaterial applications. This approach also finds its application in study based on morphology, especially for drug delivery applications and for investigations based on molecular pathways.

KEYWORDS

Cell imprint lithography; Cell replication; Patterning cells; Molecular pathways

DOI
https://doi.org/10.1088/1748-3190/ab1243